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ANNALS
OF THE
Association of
American Geographers

VOLUME XLII, 1952



HENRY MADISON KENDALL
Editor

PUBLISHED BY THE ASSOCIATION
March, June, September and December

Entered as second-class matter at the Post Office at Lancaster, Pa.
Acceptance for mailing at special rate of postage provided for in Section 1103,
Act of Congress of October 3, 1917, authorized March 28, 1923.

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Oct. 28, 1955
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ANNALS of the Association of American Geographers

Volume XLII

MARCH, 1952

Number 1

ROCKFORD, ILLINOIS: A MEDIUM-SIZED MANUFACTURING CITY*

JOHN W. ALEXANDER

University of Wisconsin

THE smaller manufacturing city plays a significant role in United States industry. In 1947 there were approximately 15,000,000 people employed in manufacturing in the United States and only 40% (5,956,000) worked in factories in cities larger than 100,000. Much has been written on industrial development in large urban areas, but comparatively little has been said about manufacturing in smaller cities (those with populations of 100,000 or less). These occupy an important place in the nation's industrial structure because they possess 60% of American manufacturing. It is the purpose of this study to analyze, from the geographical viewpoint, the development of manufacturing in one of these smaller cities.

Rockford, Illinois, has a population of 93,000 and is located astride the Rock River on the plains of northern Illinois 80 miles west of Chicago (Fig. 1). It was a rock-bottomed ford across this river which attracted migration paths, for here was the best place in several miles to cross the stream. The first settlement was in the late 1830's, and since then Rockford has forged ahead steadily as the largest commercial center and dominant manufacturing city in northern Illinois and southern Wisconsin (excepting Lake Michigan cities). An important part of its population is Swedish.¹ Through the years these people have led the way in Rockford's industrial development.

Approximately 35,000 people are employed in Rockford's 350 factories. At one time Rockford was known as "the Furniture City," but today the furniture industry is of minor importance having been surpassed by industries specializing in metal products. According to the criterion of number of employees, the most prominent manufacturing activities are those producing hardware, machine tools, machinery, and automotive parts. Of secondary importance and considerably overshadowed by the metal industries are furniture, textile, food, and leather industries. The relative importance of these in the city's industrial structure is shown in Table I and also in

* The author gratefully acknowledges the suggestions and constructive criticisms of this study made by Prof. V. C. Finch, Prof. Richard Hartshorne, and Prof. A. C. Gerlach, all of the University of Wisconsin.

¹ Over 25% of the people are of Swedish descent. The city directory lists 3000 Johnsons.

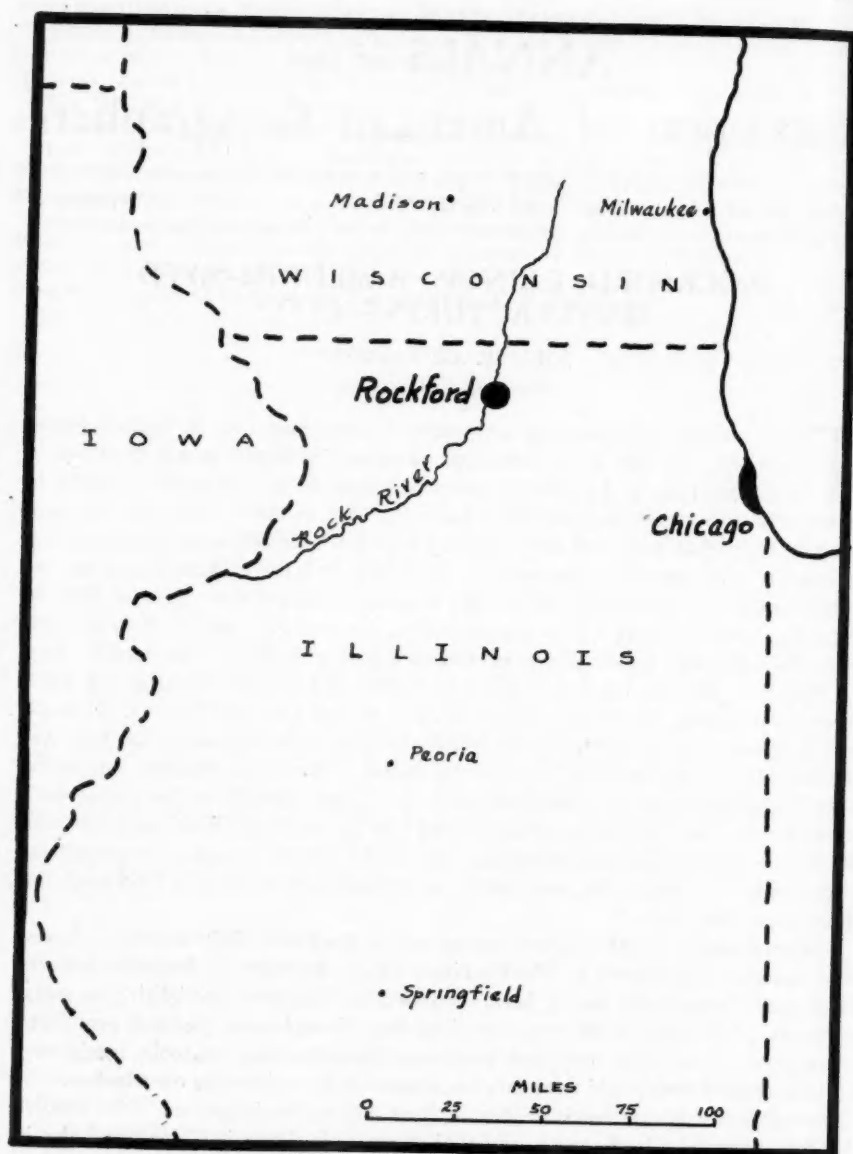


FIG. 1.

Industrial Structures 1948

Based on Employment

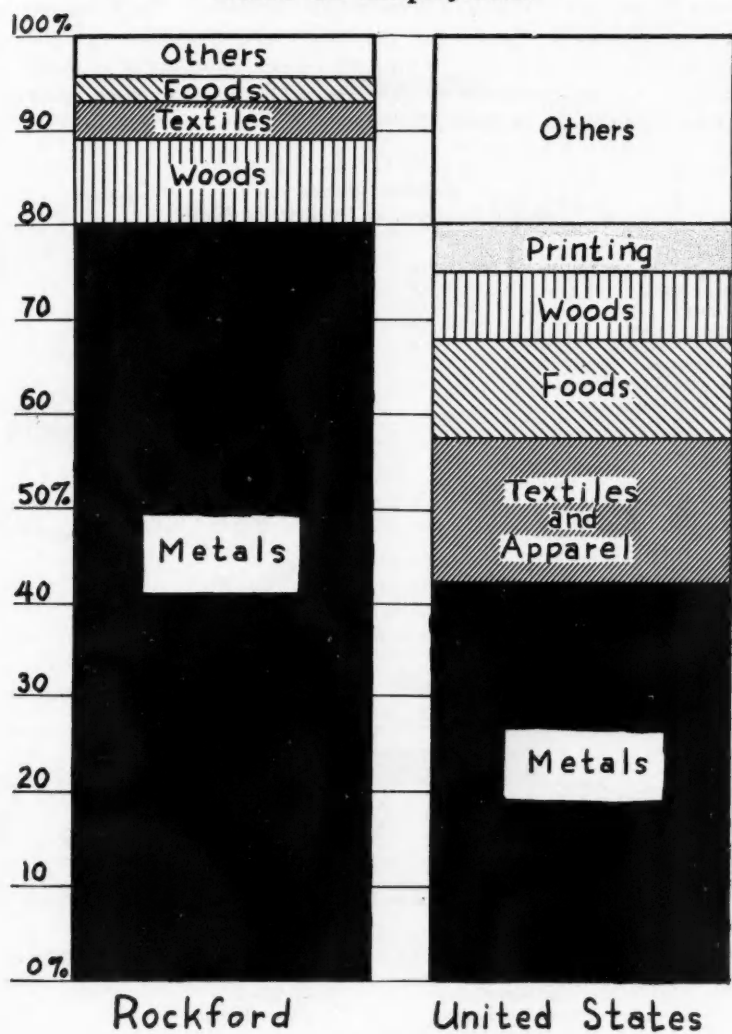


FIG. 2.

Figure 2 which offers a graphic comparison with the industrial structure of the United States as a whole.

There are 56 factories which employ at least 100 people and account for 30,000 workers or 87 per cent of the city's manufactural personnel. The metal industries dominate, as indicated by the fact that the *twenty-two* largest factories are metal-goods producers, and each employs at least 400 people. The largest employer is the National Lock Company with 3500 employees. The fifty-six major factories are classified by type and size in Table II.

TABLE I
Rockford, Illinois
Number of Employees in Industries as of 1948

Metal Products		28,000		80%
hardware	8,000		23%	
machine tools	7,000		20%	
machinery	5,500		16%	
automotive parts	4,000		11%	
foundries, forges	1,200		3%	
miscellaneous	2,300		7%	
Furniture and Wood Products		3,300		9%
Textiles and apparel		1,500		4%
Foods		850		3%
Leather		150		—
Other industries		1,500		4%
		35,000		100%

Source: U. S. Employment Service and contacts with individual factories.

TABLE II
Rockford, Illinois
Number of Factories by Type and Employment
Type of Factories*

Number of Employees	Metals						Wood	Textiles	Foods	Leather	Others
	Mh	Mt	Mm	Ma	Mf	Mx					
over 3000	x										
2000-3000		x	x								
1000-2000	x	xx		x		x					
500-1000	x	xx	x	xxx	x	x					
250- 500	x	xx		xx	x	x	xxxxx	xx			
100- 250	xxxx	x	xxx	xx		x	xxx	xxxxxx	xx	x	xx

* x represents one factory.

Factories are identified in Table II and in Figure 3 to show type and size. Initial letters indicate type of factory:

M—Metals

h—hardware

t—machine tools

m—machinery

a—automotive

f—foundries, forges

x—other metals

W—Wood products

T—Textiles

F—Foods

L—Leather

X—Miscellaneous

Numerals indicate the relative size of the factory in terms of employment. Following letters "a," "b," "c" refer to branches of the same company.

For example "Mm-3" identifies the third largest factory in Rockford, a metal fabricator producing machinery.

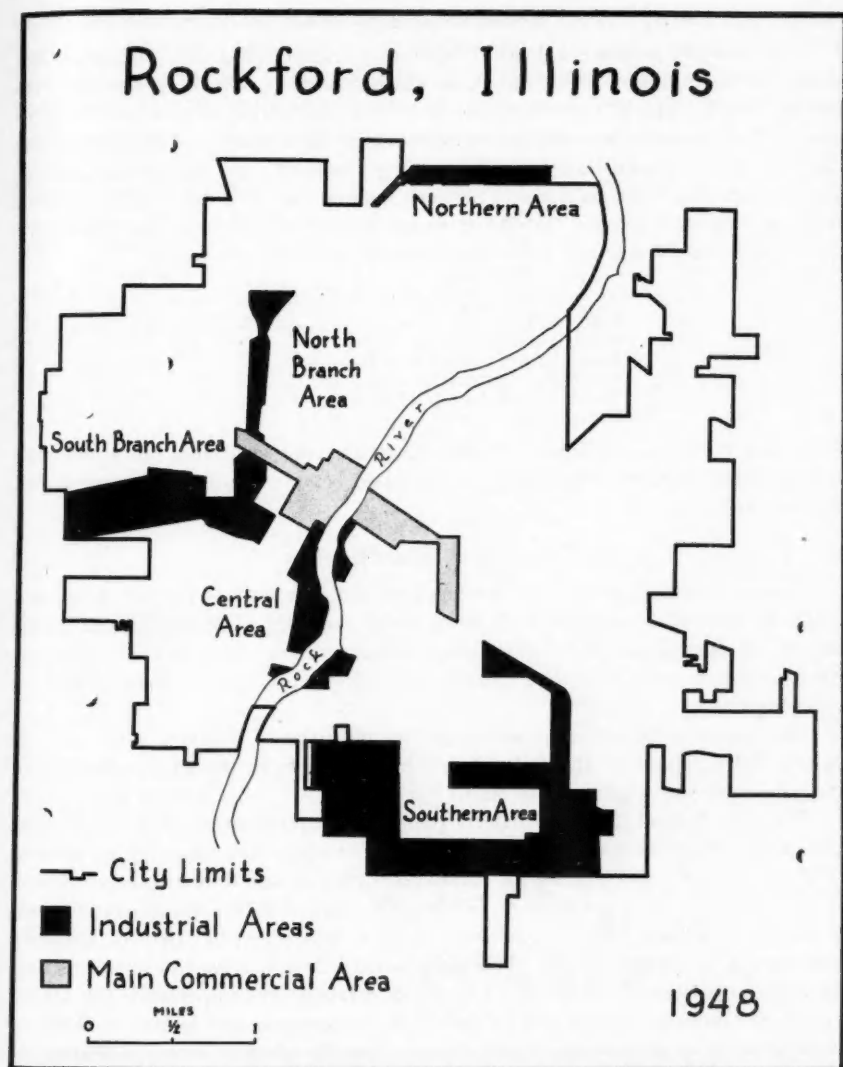


FIG. 3.

The following analysis of Rockford industry will be pursued under these topic headings: major industrial areas, leading industries, associations between industry and related elements, and trends.

A. MAJOR INDUSTRIAL AREAS

There are five separate industrial zones in Rockford (Fig. 3). The most important is the Southern Industrial Area which contains over half of the city's industry. In this part of town factories have been built adjacent to a belt line railroad. The Central Industrial Area, which contains the waterpower district, extends south of the downtown business district along the river. In the western part of Rockford are two industrial areas in the very shallow valleys of the South and North branches of Kent's Creek. The most removed zone of industry is the Northern Industrial Area, a linear belt extending along the northern city limits.

Per Cent of Rockford Industrial Employment

Southern Industrial Area	57%
Central Industrial Area	20%
South Branch Industrial Area	10%
Northern Industrial Area	6%
North Branch Industrial Area	5%
Other areas	2%

These five industrial areas are not only geographically separated, but have other distinguishing characteristics which are discussed below. Each area is represented in detail on Figure 4.²

1. Southern Industrial Area

Twenty thousand people are employed in the Southern Industrial Area, and 18,000 of them are associated with metal goods factories. Although metal trades employ the most people, this district also contains more furniture factories than any other portion of town. No other type of industry is represented here by more than a single plant.

The Southern Industrial Area has an open pattern of industry with solid industrial belts paralleling the railroad belt line which is in the shape of a square enclosing over one square mile of land (Fig. 4).

The story behind this quadrilateral pattern of manufacturing is unusual. The first factories here were furniture plants, a string of which were constructed between 1872 and the early 1900's along the main line of the Chicago & Northwestern tracks on land donated from the farm of Gilbert Woodruff. When the Illinois Central constructed its line through Rockford in 1880 it secured A. W. Brown, Rockford businessman, as its local agent. This man owned a farm southeast of what was then the built-up portion of town. His first major strategy was to persuade the Union Furniture Company (whose first factory on the waterpower had burned in 1888) to build anew on a part of the Brown farm. The site chosen is now a portion of National Lock Company property (Mh-1 on Fig. 4). For the furniture company, Brown built a spur track south from the main Illinois Central line and west to the factory. In 1905-06 the Illinois Central constructed what then seemed a fantastic belt line through the flat corn fields around the south end of town enclosing over one square mile within its loop. The explanation of this involves another railroad com-

² Factory symbols in Figure 4 are explained in the footnote to Table II.

pany (now defunct) which was building into south Rockford. To save this territory the Illinois Central hurriedly threw the belt line around the south part of town. The new road approaching Rockford (just south of the present property of the J. L. Clark Company, Mx-10) was then refused permission to cross the Illinois Central

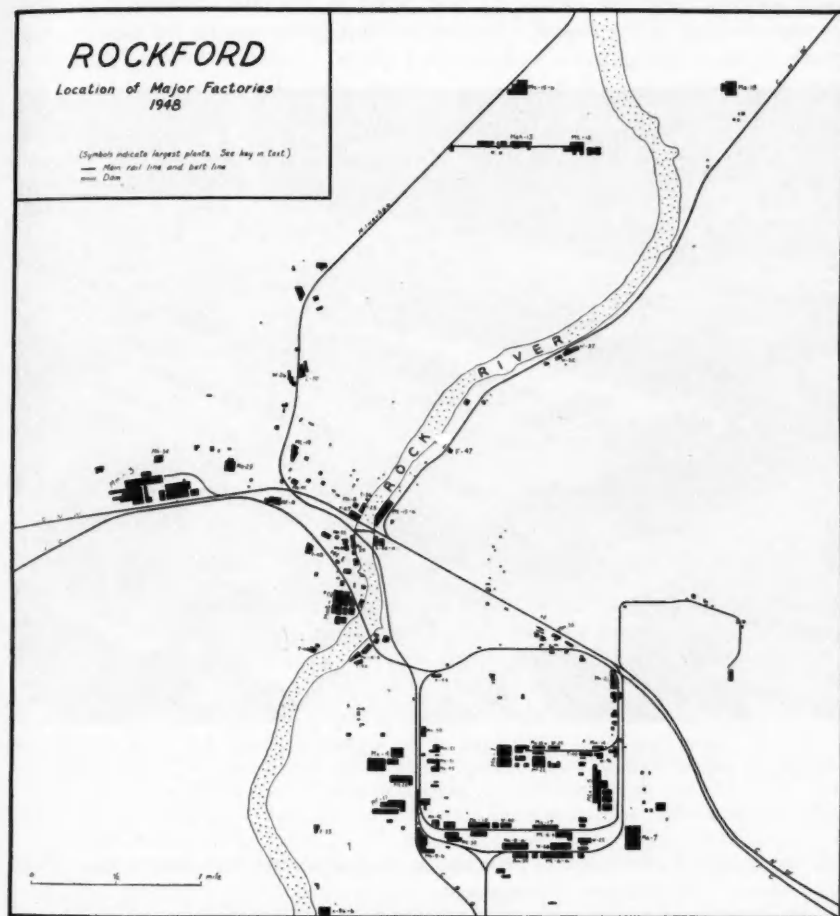


FIG. 4.

right-of-way and therefore was forced to encircle the Illinois Central belt line. Subsequently the new company collapsed and its tracks were purchased by the Chicago, Milwaukee, St. Paul, and Pacific Railroad. Flat land served by this ideal belt line made an attractive area for factories. New factories continue to take root here. Rockford industry is expanding to the southeast.

The southern side of the belt line is flanked by continuous industrial zone for over a mile and a half. A thin forest of twenty chimneys and a few water tanks on factory roofs mark the larger plants. Figure 5 is an aerial view of the western end of this industrial belt which is typified by one-story metal working factories and four-story furniture factories (Fig. 6). The noise of numerous throbbing factories through this belt is like that of a muffled murmur dominated by the rapid thump-thump-thump of diesel power units in some plants. Noise is the only nuisance in



FIG. 5. Aerial view of the western end of the southern industrial belt along the belt line railroad. Rockford Machine Tool Company, Mt-30, in the foreground. In the left background is a furniture factory, in the central background is a metal container factory, and in the right background is another furniture factory.

this neighborhood; there is very little smoke since no factory uses much coal. There is no odor. Factories are not congested.

The residential areas marginal to this Southern Industrial Area are surprisingly clean and well-kept. Lots average 150 feet by 50 feet and the setback line averages eighteen feet. Houses are well maintained one- and two-story frame structures. Lawns are neat and frequently landscaped with shrubbery. There is room for a large garden plot behind each home. Streets are lined with trees (Fig. 7).

Typical products of the Southern Industrial Area are fabricated metal goods: hardware, stoves, machine tools, universal joints, piston rings, sewing machines,

pencil sharpeners, and tin containers. Primary metal production is represented by one large foundry. There are several furniture factories. Other types of industries are inconspicuous.

There are several large factories in this part of Rockford. Of Rockford's eight factories employing 1000 or more people, five are in this "belt line industrial zone." Here is the city's largest factory, National Lock Company, Mh-1, which employs 3500 people fabricating a wide line of hardware. The George D. Roper Corporation, Mx-4, is Rockford's fourth largest factory and produces stoves. Greenlee Brothers, Mtx-5, manufacture machine tools and miscellaneous metal items. The

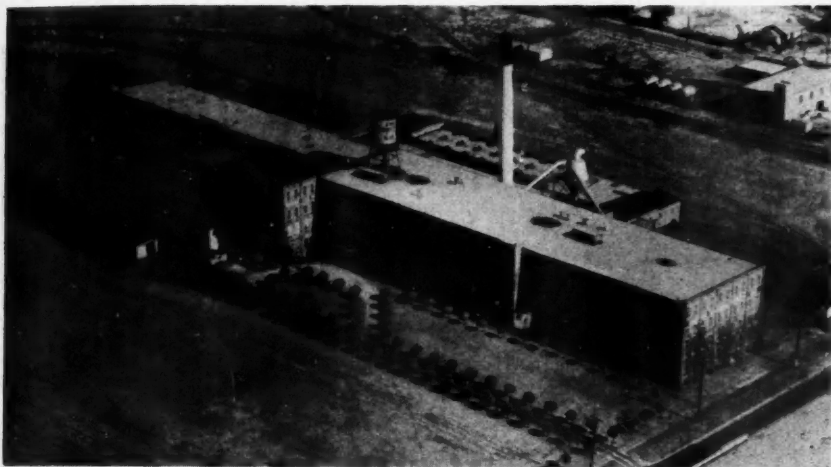


FIG. 6. This building typifies the architecture of Rockford's furniture factories. Practically all of them are four stories tall, of gray brick construction with flat roofs and a monotonous array of single windows which are spaced with mathematical regularity on all floors on all sides of the building. (Weiman Furniture Company photo.)

Sunstrand Company, Mt-6-a produces machine tools; recent expansion has necessitated the construction of a second plant, Mt-6-b. Mechanics Universal Joint Company, Ma-7, makes universal joints primarily for the Detroit automobile market.

Of the 30 largest factories in the Southern Industrial Area, 21 originated in Rockford. Eleven of these owe their existence to inventions of local people. Nine companies moved to Rockford from other communities.

Ten of these 30 factories originated on the old waterpower district³ (Central

³ The Mechanics Universal Joint Company, Ma-7, exemplifies the role of *invention* and *waterpower* in the establishment of Rockford factories. Originally this organization was on the waterpower and produced a machine tool known as "Mechanics Machine," but in 1912 the company president, P. A. Peterson foreseeing the possibilities in the automobile industry, sold out the machine tool business and entered the automotive field. The company ultimately specialized in universal joints. For years the product was similar to that of competitors—a grease lubricating joint which had to be lubricated every 500 miles. Then the company's engineers invented

Industrial Area) and moved to the southeast when their growth necessitated greater space.

2. Central Industrial Area

The Central Industrial Area extends for three-fourths of a mile along the Rock River. Approximately 7500 people are employed in factories in the Central Area, and nearly 6000 produce some sort of metal goods. The textile industry is also conspicuous. There is only one small furniture factory. The main commercial district encircles the north end of this area, while around the south end is a residential district somewhat blighted and of lower grade than that associated with the Southern Industrial Area.



FIG. 7. Factories of the Southern Industrial Area rest side by side with clean, commodious residential areas. Neighborhoods are dotted with trees, houses are well-painted, in a good state of repair, set back from the sidewalk, and not crowded together. Individual garages occupy the rear portions of lots. (Elco Tool and Screw Company photograph.)

Typical products of this area are textile machinery, machine tools, hardware, and hosiery. All of Rockford's textile industry (six factories employing an aggregate of 1500 people) is located here. All six mills produce hosiery. The largest metal working factory here specializes in producing textile machinery.

an oil lubricated joint which was much more efficient because vehicles could run for thousands of miles before the joint needed lubrication. On the impetus of this invention the company has risen to prominence in the automotive industry and now produces 40 per cent of the nation's universal joints. Three-fourths of the output goes to Detroit by truck for assembly into automobiles. The remaining quarter is purchased by tractor manufacturers in the Midwest.

The waterpower district is located along the west side of the river for a quarter of a mile below the dam (Fig. 4). It was here that Rockford industry had its start. At one time the mill race was tapped by 17 arches or channels over which factories generated power. The first saw mills, flour mills, and agricultural implement factories in Rockford were based on this waterpower which has been the seedbed for Rockford industry for nearly a century. From this small area have come numerous companies, now some of the city's largest, which started in small buildings only to outgrow the limited capacities and move to other parts of town. In no other part of Rockford are factories so close together; throughout most of "the waterpower" they abut one another. There is no room for landscaping, and the section appears dirtier than most industrial localities in the city. Some of the factory buildings are almost 100 years old. Most of them are two stories tall. Many are made of stone which was excavated when the mill race was dug. In recent years more and more of these little factories have found it economical to buy their power from the Central Illinois Electric and Gas utility, and today only three small companies (other than the public utility) operate waterwheels. Water rights of these three organizations are being bought up. Abandonment of waterpower usage will enable the mill race to be filled with cinders and dirt, producing building sites for more factories. Almost all of the companies in the waterpower district are small metal fabricating plants.

The electric power plant, X-56-a, is located at the east end of the dam, makes electric power using steam turbines, and consumes between twelve and fourteen carloads of coal daily. This is seven or eight times as much coal as is consumed by any other Rockford industry. Of 256,000,000 kilowatt hours of electric power produced, only five million are generated by water power at the dam. This factory's market area includes only Rockford and small neighboring communities. New steam-generating stations are being constructed south of town along the river, X-56-b.

To both north and south of the old waterpower district are newer factories—secondary metal fabricators and textile mills.

Two of Rockford's largest factories are here. The Barber-Colman Company, Mmt-2, has an employment surpassed only by that of National Lock and produces textile machinery and machine tools. American Cabinet Hardware Company, Mh-8, employs over 1000 people making cabinet hardware.

All of the industries in the Central Industrial Area are of local origin. The larger companies started either with inventions⁴ or as offshoots of other companies.

⁴ Barber-Colman was organized in 1903 to produce textile machinery and is one of Rockford's many factories which owe their start to a man's invention. Howard Colman was a young inventive genius who tinkered with machinery for the fun of it. He became interested in textile machinery in a small textile mill next door to his home in Beaver Dam, Wisconsin. At the age of 16 he invented a warp tying machine and had to go to Rockford to find a shop that could make one for him. Subsequently, on the basis of this invention, the forerunner of Barber-Colman was founded.

3. *South Branch Industrial Area*

About 3500 people (10 per cent of Rockford's industrial employment) are in a dozen factories located in the broad shallow valley of South Branch of Kent's Creek. This is one of the most homogeneous belts of industry in Rockford, for practically all the plants are metal fabricators. Buildings are all one- or two-stories. Leading products are farm implements, clutches, and hardware.

There is no waterpower in the small stream which drains this area. Industry spread through here comparatively recently because of satisfactory building sites along railroad lines.

Rockford's third largest factory, J. I. Case Company, Mm-3, produces a wide array of farm implements and is a descendant of a forerunner company which originated "on the waterpower."

Among Rockford's large factories the Case Company is unique because its main market is in the Midwest. Today it is the only vestige of the farm machinery industry which dominated Rockford's industrial complex between 1850 and 1880.

4. *North Branch Industrial Area*

Trending north from South Branch is the North Branch Industrial Area, paralleling the Milwaukee Railroad. This is the least important of the city's five regions of manufacturing. Only 1500 people are employed by industry, yet this is the most heterogeneous collection of factories in Rockford. Numbered among its 20-odd plants are five metal fabricating plants, three wood working factories, two leather establishments, two dairy products companies, two paper products establishments, and a small rug company.

The largest factory here employs less than 500 people. Yet it is a national leader in the production of machine tools called "honing machines." Originally located "on the water power," this factory moved to its present site, Mt-19, for expansion.

5. *Northern Industrial Area*

On the flat land just outside the northern city limits is an industrialized strip of territory nearly a mile long and only a block wide. The area consists of metal working factories, and the total employment is less than 2000 people. This is a comparatively new area with the first factory being built about 50 years ago.

The Ingersoll Milling Machine Company, Mt-12, is the largest Rockford factory devoted exclusively to producing machine tools. It also is the only machine tool factory in north Rockford. The factory is located across the street from one of the highest class residential sections adjoining Rockford industry. This is not surprising for the factory itself is immaculate. Considerable lawn space in front is landscaped with trees and shrubbery (Fig. 8).

Other Industrial Areas

The downtown business districts on both sides of the river are sprinkled with numerous small factories of diverse types: bakeries, dairies, bottling works, a news-

paper plant, metal works, awning shops, and many others. A mile to the northeast of this commercial core is a group of three furniture factories on the east side of the river. In northeast Rockford is the new home of Woodward Governor Company, Ma-18, national leader in production of governors. This new factory is unique in Rockford, with spacious lawn, artistic landscaping, brick construction, and an *absence* of windows. Artificial air-conditioning can be maintained better without windows.

B. LEADING INDUSTRIES

Rockford is a city of secondary fabricating plants with metal goods predominant. The rank of major industries is shown in Table I. The following discussion focuses attention on the three leaders: metal goods, wood products, and textiles.

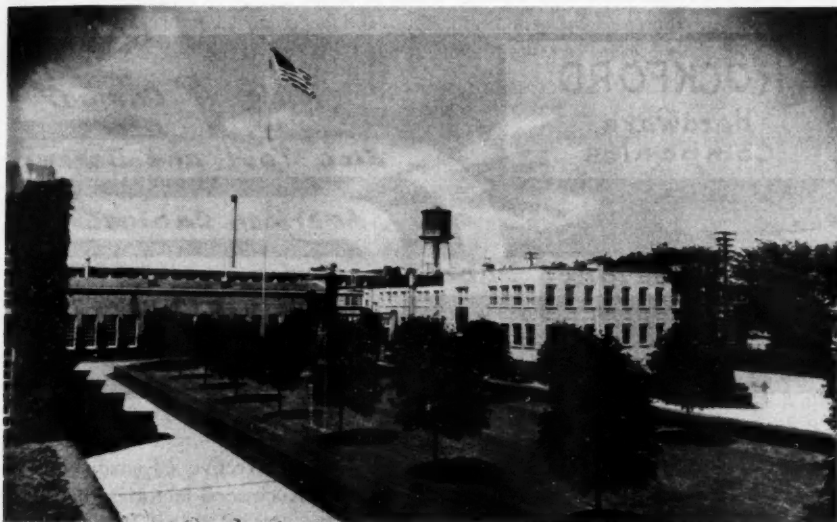


FIG. 8. The Ingersoll Milling Machine factory is one of the most attractive factories in Rockford. Across the street to the south of this plant is one of Rockford's highest class residential sections. Adjacent to the factory's northern border is the Rockford Golf and Country Club.

1. Metal Goods

Approximately 28,000 people, 80 per cent of Rockford's industrial employment, produce metal goods.

Hardware is the leading product and all of the major hardware factories were born in the city, most of them sprouting from the National Lock Company.

The history of the National Lock Company is significant, for it was Rockford's first hardware factory and from it have grown most of the important factories in Rockford's most important industry (Fig. 9). The formation of the company in 1903 was related directly to the furniture industry which for thirty years had been

Rockford's leading manufacturing activity. For years Rockford furniture factories had been buying furniture locks in the East, but these locks were designed to be placed on the surface of the furniture. In time, a Rockford Swede named Levin Faust designed a lock which was more satisfactory to Rockford furniture makers, one reason being that it was concealed within the wood. In 1903 F. G. Hoglund and P. A. Peterson organized the National Lock Company on the waterpower to produce these locks. Soon it added to its line another item, furniture hinges, which also had previously been purchased from eastern fabricators. Other items were added, and today this company produces the most diverse line of hardware in Rockford. The Company cultivated markets outside of Rockford, and soon most of its production was selling in other cities in the Midwest and East. Subsequent growth has been most rapid since 1937 during which time the company trebled its produc-

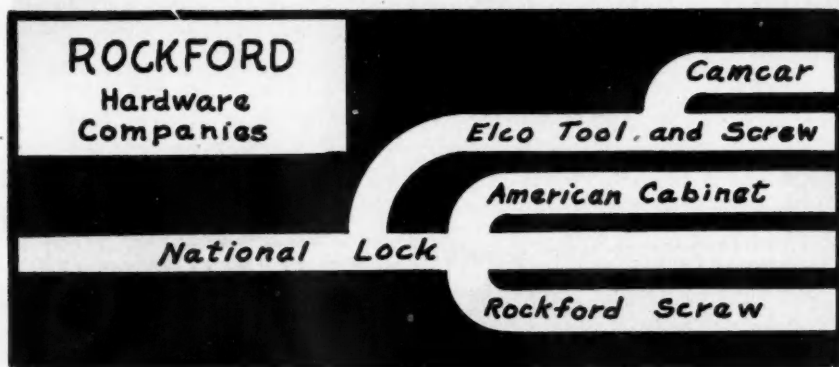


FIG. 9.

tion in response to an increasing demand stimulated by effective salesmanship and the production of a satisfactory product. Like most Rockwood factories this company trucks in about 50 per cent of its raw materials. Practically all of its finished products move out of the city in trucks, destined generally for Chicago and eastern markets. Approximately 85 per cent of its employees live in Rockwood. An unusual proportion of workers, about 40 per cent, are women.

Rockford is more famous for its *machine tools* than for hardware. Its nine major machine tool factories supplement each other's production, one specializing in drills, one in honing machines, another in lathes, still another in shapers. The machine tool industry got its start in 1868 resulting directly from inventions of two brothers, W. F. and John Barnes who were pattern makers in a reaper factory. In the construction of their wooden patterns the Barnes brothers had to do considerable sawing on the pieces of wood, and in the 1860's they designed a foot-powered jig saw to expedite the operation. In 1868 they started a company of their own to manufacture these saws, and in subsequent years invented an upright drilling machine which became their main product.

The *machinery* industry is very diversified with leading factories each making a different product: textile machinery, farm machinery, sewing machines, electrical machinery, wood working machines and ice cream packing machines. The first major machinery production here was in the 1850's when a reaper factory was started. The famous John P. Manny Company made the widely-known Manny reapers and was the first Rockford factory to receive a nation-wide reputation.

The *automotive* industry specializes in production of automotive parts. No vehicles are assembled. The heterogeneity of Rockford's automotive industry rivals that of the machinery industry. One factory makes joints, another automobile hardware, another piston rings, and others make clutches. The major market is in Michigan and Indiana. All but one of the city's eight major factories in this industry were launched in Rockford. Local men conceived ideas for automotive equipment and started from scratch to make the items, or else companies developed successful specialities and abandoned their former items of production. Four of the factories are graduates of the waterpower district.

The metal industries as a group consume iron and steel from south Chicago, Gary, and Ohio or Pennsylvania steel centers. Several of them operate their own foundries and burn coal which is procured in southern Illinois and Indiana. Most of them depend for power upon electricity furnished by the local public utility. Their major markets are in northeastern United States. The only required item supplied by the Rockford area is a skilled and productive labor supply and "a good place in which to live." It is significant that almost all the presidents of these metal-working factories said that the only advantage which Rockford possessed for their industries was "good labor" and that if they had the opportunity to relocate their plants in any place in the United States they would come right back to Rockford.

The metal industry as a whole is comparatively new in Rockford having developed mostly in the past 50 years.

2. *Wood Products*

The entire wood working industry employs no more people than does the National Lock Company. A variety of wood products are made but furniture is the most important. Only eight wood-working plants employ 100 or more people, and the two largest employ 350 each. All but one of the factories are located in east Rockford, most of them along the belt line railroad. The concentration of these factories east of the river is related to the fact that practically all Rockford furniture factories were established by Swedes, most of whom live in east Rockford.

Rockford's furniture factories specialize in cabinets, desks, tables, bedroom furniture and chairs. There has never been much production of upholstered items. Rockford furniture is of medium and high quality with heavy emphasis on special designs such as 13th Century, English, Colonial American, and modern. Raw materials are drawn from a distance—pine from northern Wisconsin and Canada, oak and maple from southern Indiana and Appalachia, poplar, beech and gum from the southeastern states, and mahogany from Central America and central Africa.

The furniture industry finds labor supplies very tight in Rockford because of the difficulty of competing with metal industries which tend to pay higher wages. Consequently, Rockford factories specialize in high quality woodwork which is marketed in the East and the Los Angeles area. The midwest market has been taken by southern furniture producers. Because the market is so remote, the furniture moves primarily by rail. Most of the furniture factories belong to the Rockford Furniture Association which owns and operates the Rockford Transfer Company for shipping furniture. This company functions in a warehouse (an old furniture factory) where producers pool their products until there accumulates a carload for a particular destination. Eighty per cent of Rockford furniture moves through this outlet.

The wood industry is Rockford's oldest industry. Moreover, much of today's metal industry developed in the wake of the wood industry. Therefore attention will be given at this point to the manner in which it got its start in Rockford.

There are varying accounts of how furniture manufacturing came to be a major industry in Rockford. There were a few small cabinet factories in the 1850's and 1860's. At any rate, major roles were played by two Swedes, Andrew Johnson and J. P. Anderson, who owned a planing mill on the waterpower and developed the idea of branching out into furniture production. In 1872 they organized in east Rockford the first important furniture factory. Swedes constituted most of this factory's personnel. In 1876 some of them withdrew to form a company of their own, and by 1882 eight such furniture factories had been organized. In these early years the market for Rockford furniture was restricted to midwestern states, but in 1882 Robert Bauch designed a combination book case-writing desk which caught the nation's fancy, and this one piece of furniture proved to be the key to national fame for Rockford's furniture industry. In the space of a few years a string of factories had spread along the railroad tracks in east Rockford. By 1893 the city had twenty furniture factories, all run by Swedes. The industry reached its apex in 1926 when 35 furniture factories employed 4000 men. In the 1920's the rapid growth of the furniture industry in southern states took most of the business away from northern producers who could not compete with the cheap southern labor.

Very few Rockford furniture men say they would return to Rockford if they were free to relocate; they all would go south mainly to be near cheaper labor. Many furniture factories have been vacated since 1926, and today one frequently finds warehouses and other industries occupying buildings which from a distance look like furniture factories (Fig. 6).

In several ways the furniture and wood-working factories are inter-related with other Rockford industries. They buy furniture hardware from Rockford hardware factories; one produces sewing machine cabinets for (and is owned by) a sewing machine company; and through the years the capital and mechanical skills of the furniture industry have served as bases for other new industries getting started in Rockford.

3. Textiles

Rockford's textile industry employs about 1500 people in the six hosiery mills of the Central Industrial Area.

Raw materials come from the nation's major sources, which are in the East: processed wool from Philadelphia and Boston, cotton from southern states (mostly from Georgia), and nylon from Buffalo. The local public utility supplies practically all the power. Although located on the banks of the Rock River, the mills make no use of its waters. Their tremendous requirements for *clean* water are supplied by wells; power is purchased from the public utility; and waste is required to be channeled into the sewage system. The market is nationwide, but most of the hosiery and all of the woolen fabrics are shipped into northeastern United States. The local labor element is 60 per cent male and 40 per cent female.

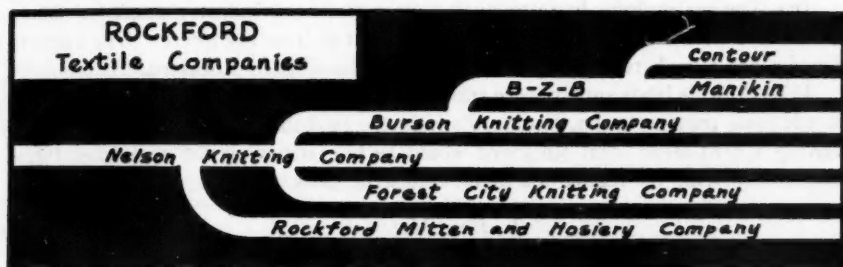


FIG. 10.

The textile industry in Rockford started as an idea in the mind of a Swedish woodworker, John Nelson, who liked to tinker with machinery and while pursuing his hobby designed a knitting machine which, in 1870, knitted a seamless sock that received nation-wide acclaim as "the old Rockford sock." In 1870 the Nelson Knitting Company was organized and from this company have descended all of Rockford's hosiery mills (Fig. 10).

Textile mills are not flourishing in Rockford as are the metal industries. They compete against the metal interests with difficulty in the Rockford labor market, and the heads of most textile plants said that if it were possible they would move from Rockford to the South because of cheaper and more abundant labor.

C. ASSOCIATIONS BETWEEN INDUSTRY AND RELATED ELEMENTS

Certain relationships involving manufacturing in Rockford can be observed for both the present and the past. Mention will be made of seven relationships between manufacturing and (1) the human element, (2) raw materials, (3) power, (4) market, (5) capital, (6) transportation, and (7) housing.

1. The Human Element

The human element has been a factor in Rockford industry in three ways: inventing, managing, and laboring.

(a) *Inventions* by local people were the stimulus for founding much of Rockford industry. The textile industry began with Nelson's invention of a sock knitting machine. The furniture industry was catapulted into national prominence by Bauch's design of a combination desk. The hardware industry was launched on an idea for a new type of furniture lock. The machine tool industry was born with the invention of the Barnes brothers' power tools.

Twenty of Rockford's 56 largest factories (those employing 100 or more people) can be traced back directly to local inventions.

(b) *Entrepreneur* initiative is evidenced in the large number of factories which were not only established to produce items invented by local people but were also established as independent offshoots of existing companies. The entire textile industry is in this category as is also most of the furniture industry and a considerable portion of hardware production.

(c) The major local basis today for most Rockford industry is *skilled labor*. Raw materials and fuel for power must be brought in from elsewhere. The markets likewise are elsewhere. But productive skilled labor is in Rockford.⁵

If Rockford's labor supply were transferred to any other midwestern city served by adequate transportation, Rockford's industry probably would move with it, for moving skilled labor from Rockford would be like removing the coal from Pittsburgh—depriving the region of a major industrial basis.

2. Raw Materials

Originally Rockford industry was based on two local raw materials: wheat for flour mills and timber for saw mills. Both resources have disappeared from the region. Flour mills gave way to other industries which took their places on the waterpower they had helped develop. Saw mills gave way to wood working plants which now must reach hundreds of miles into Canada and Appalachia for raw materials.

Metal fabricators and textile mills, as has been observed, always have had to draw their raw materials from eastern sources.

3. Power

Practically all of the power feeding Rockford factories is generated from coal brought from southern Indiana and Illinois.

Originally local water power was a major factor in giving birth to manufacturing. Rockford industry was born in the water power district. In fact, 13 of the 56 factories employing 100 or more people originated in structures along the mill race.

But waterpower is no longer significant. The amount of power generated by the 10-foot waterhead of the dam is inadequate in quantity and irregular in flow. Companies find it more economical to purchase electricity from the local public utility

⁵ An analysis of how this labor pool accumulated in Rockford as well as a more detailed description of other location factors is presented in the author's "Manufacturing in the Rock River Valley—Location Factors," *Annals of the Association of American Geographers*, XL (September 1950): 237-253.

whose plant at the eastern end of the dam generates 98 per cent of its electricity by steam driven turbines.

4. Markets

Less than 5 per cent of Rockford's industrial production is marketed in the vicinity of Rockford. Most of it moves eastward.

Originally local markets created the demand for flour, lumber, and other products of Rockford factories. But once underway in supplying this demand, Rockford industry expanded to serve a widening market.

5. Capital

Rockford capital has been friendly to industry. At one time nearly 60 per cent of Rockford bank investments were in manufacturing companies. Furthermore, local citizens have invested heavily in industry.⁶

6. Transportation

The pattern of industry in Rockford conforms closely with that of railroads, of which there are four serving the city. The Illinois Central with nine freight trains and three passenger trains running each way daily gives more service than the other three roads combined. The Chicago and Northwestern has a spur leading northeast along the east bank of the Rock River. The Chicago, Milwaukee, St. Paul and Pacific route is a branch line from the north. The Chicago, Burlington and Quincy has a branch from the south. In addition, there are the belt lines which have attracted industry to their sidings.

Truck service to industry is steadily increasing. Rockford is served by fourteen trucking companies, of which all but the three largest run only to Chicago and Milwaukee. Approximately 200 common carrier trucks enter and depart from Rockford daily.

7. Housing

Residential areas contiguous to Rockford factories are of high quality. Instances of blight are rare. Most factories are clean and neat on the outside with no great piles of coal or objectionable raw material. Residential areas bounding them are likewise generally clean and consist of well-maintained homes on large lots with considerable set-back lines, appreciable lawn space, shrubbery, and numerous trees. For a city of about 100,000 inhabitants Rockford has a surprisingly small area of slums. A visitor can drive through and around Rockford for a long time before locating anything approaching serious blight. The absence of such areas would be commendable for even a non-industrial city, and the fact that Rockford with all its industry has so little is a commentary on what the factories have done to the geography of the city. The one spot of very bad housing is beyond the southwest corner of the Southern Industrial Area.

The rapid expansion of industry in recent years is associated with a substantial growth in population. In 1940 the city's population was 84,000. In 1948 the

⁶ *Op. cit.*, p. 248.

estimate for the city was 93,000. This expansion has strained the housing situation. About 2000 families reside in temporary housing of various descriptions in several separate areas fringing the city. The largest of these extends for a mile south of the belt line railroad. It is a vast agglomeration of orderly spaced trailers and neat one-room houses all closely packed together. Near the river the house types deteriorate to shanties. There are few trees to break this monotonous expanse of houses. South of the J. I. Case factory, Mm-3, is a similar but less extensive area of temporary housing. The two districts mentioned so far are the only ones located proximal to industrial areas. No industry has undertaken any extensive housing projects.

D. TRENDS

Industry in Rockford has shown a steady increase in every decade of the city's history except the depression period 1929-1939. (Fig. 11).⁷ In 1948 industrial employment was at an all-time high of 35,000. The trend did not reach a peak during World War II to taper off at the end of hostilities (Fig. 12). Although a slight recession occurred in 1945, by 1946 industry had returned to its war time level and subsequently exceeded it.⁸

A trend is discernible in the increasing number of women workers. In 1940 they constituted only 15 per cent of the industrial labor force. During the war the proportion reached 30 per cent, but quickly declined to 20 per cent in the immediate post-war period. Subsequently it has increased to 23 per cent. Since the total force has been increasing it means that the absolute number of women workers has been increasing also.

There has been a trend in leading types of industry. Originally in the 1850's Rockford was a flour-milling and saw-milling town. Soon the fabrication of agricultural implements became the leading industry, and for years Rockford was known as "The Reaper City," also maintaining through the Civil War its reputation as the heart of the Rock Valley "Bread Basket of the United States." Then the furniture industry rose to prominence and between 1880-1926 Rockford rightfully earned and maintained the reputation of "The Furniture City." Simultaneously the hosiery industry developed, and Rockford also became known as the home of "the old Rockford Sock." Since 1926 the furniture industry has receded. It was surpassed by metal industries of which hardware and machine tools are currently the most important, each employing nearly twice as many people as furniture factories did at their peak. In recent years Rockford has received the name of "The Machine Tool City."

In areal expansion of manufacturing the dominant trend has been toward the

⁷ Figure 11 is based on data contained in the United States Census of Manufactures. Rockford statistics for past years are available only for *wage earners* and not for all *employees*.

⁸ Figures are not available on manufacturing employment in Rockford for the period 1940-1948, but the Illinois Employment Service does have such data for what it terms "The Rockford Area" which includes most of Winnebago and Boone Counties. Since Rockford accounts for 95% of the industry in these two counties the trend in the graph in Figure 12 is the trend of Rockford industry although the absolute values are not.

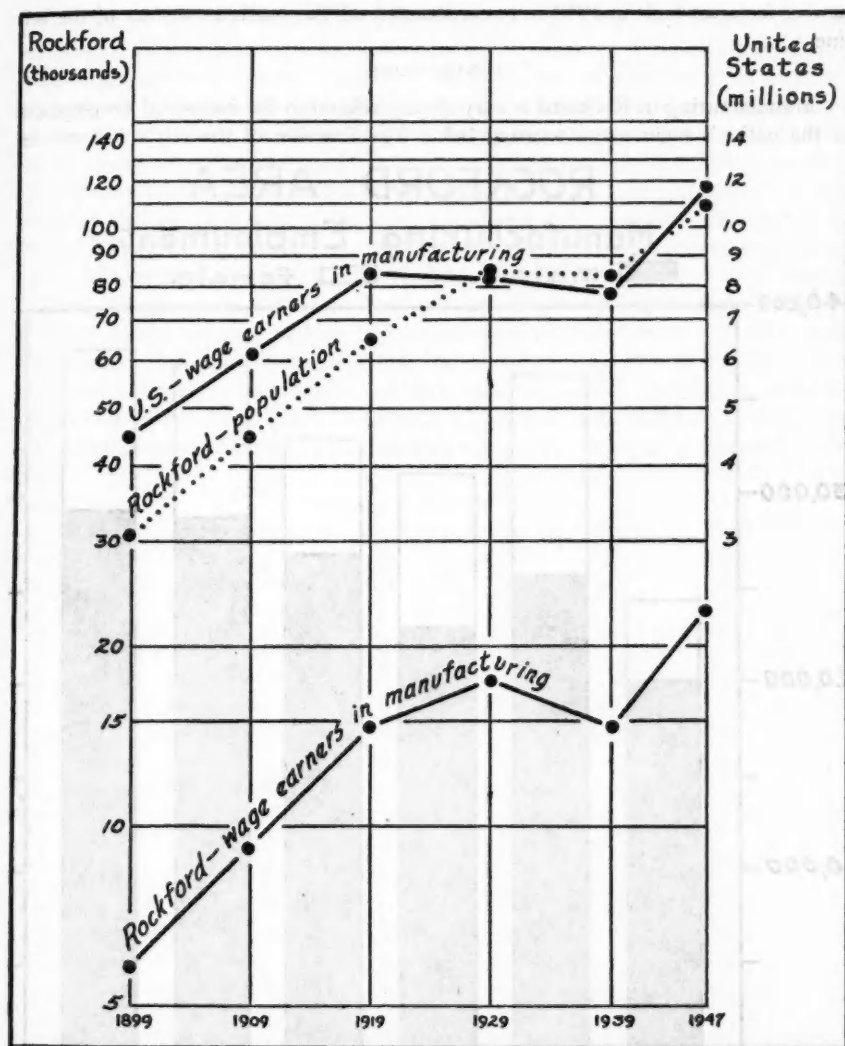


FIG. 11.

southeast. Industry began on the waterpower and spread up the two branches of Kent's Creek and down the west side of the Rock River. In 1872 it crossed the river and took root along Railroad Avenue from which it spread south. With the exception of relatively recent construction on the northern outskirts of town, nearly all new factories have been built around the belt line in south Rockford. Rockford's

newest factories built in 1948 were constructed off the southeast corner of the belt line.

CONCLUSIONS

Manufacturing in Rockford is very closely related to the industrial development of the nation's main manufacturing belt. The function of the city's industry in

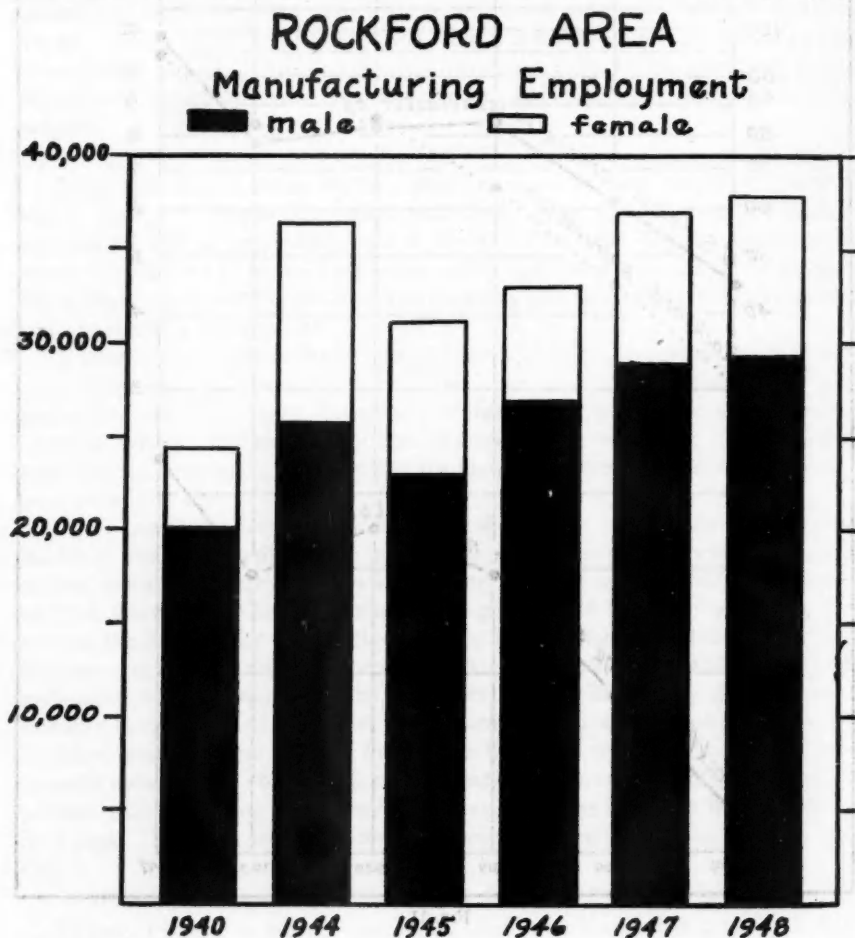


FIG. 12.

general involves the procurement of raw materials and fuel from eastern sources and the shipment of products to eastern markets. This generalization is most applicable to the metal goods fabricators (which account for 80 per cent of Rockford's industry).

Within the city's industrial structure there is very little relationship between industries. Historically there has been a strong connection—the hardware industry is an offspring of the furniture industry, the production of machine tools branched off from the farm machinery industry, and the machine shops made the textile machinery with which the textile industry began operating. However today there are very few instances where the function of one industry is related to that of another. A very small portion of the output of Rockford's hardware factories is taken by her furniture factories, but most of the hardware is marketed elsewhere, particularly in the east. Local foundries supply metal fabricators with castings, but again much of the production is sold in other areas. One furniture factory concentrates on sewing machine cabinets and actually has been purchased by a sewing machine company. A slight fraction of the machine tool output goes to Rockford metal fabricators. Nevertheless, the interrelationships between Rockford factories as sources of raw materials, equipment, or markets for each other is minor. Rockford's industry utilizes raw materials which, in general, are procured from factories in the East; her industry serves a market which, though nationwide, likewise is centered in the East.

OCCUPYING THE WET PRAIRIE: THE ROLE OF ARTIFICIAL DRAINAGE IN STORY COUNTY, IOWA

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SOME attention by geographers to the statistics from three United States censuses of drainage and to the chapter on reclamation of wet and overflow lands in a textbook on conservation¹ has led to the realization by a part of the geographical profession that there is considerably more drained land than irrigated land in the United States and that the major portion of the drained land forms a relatively continuous arc from southeastern Michigan and northwestern Ohio, through Indiana, Illinois, and Iowa to the northwestern corner of Minnesota. This great arc of drained land for over two-thirds of its length runs through the prairie. The great extent of naturally wet land in the Midwestern prairie, the fact of the reclamation of the wet land, and the results of the reclamation are all comparatively unknown.

The common unawareness of the drainage of formerly wet land on the part of the American public and geographers alike is in contrast to the interest in the irrigation of dry land. The unequal attention given irrigation and drainage may be explained in two main ways. 1) Irrigation produces marked local areal differentiation; whereas, drainage reduces local differences in landscape appearance and use. 2) The fact of irrigation is usually evident in the presence of ditches and men at work directing the flow of water whereas most artificial drainage takes place automatically through tile buried in the ground.

It is the purpose of this paper to examine in some detail the character of the occupation and utilization of a small portion of the poorly drained prairie in the north central portion of the United States, on the assumption that some generalizations may be discovered that can be tested later in a larger setting. The area selected, Story County, Iowa, is representative of the Iowa wet prairie. It lies within the Mankato Lobe of late Wisconsin glaciation, the major region of poor drainage in the state (Fig. 1). Like the larger region, it contains both till plain flats of extensive poor drainage and undulating to gently rolling land marked by numerous small poorly drained depressions. The amount and arrangement of naturally wet prairie land varies greatly within the county, facilitating the comparison of wetter and less wet areas. Because Story County lies at the southeastern edge of the major area of wet prairie in the state, it was among the first of the fairly wet counties of the state to be settled. Accordingly, the record of drainage may be the more meaningful because of the length of time involved.

¹ George J. Miller in *Our Natural Resources and Their Conservation*, 2nd edition, edited by A. E. Parkins and J. R. Whitaker. John Wiley and Sons, New York, 1939. pp. 152-168.

THE WET PRAIRIE IN STORY COUNTY

Wet prairie was the designation in common use for poorly drained prairie and other non-forest vegetation of poorly drained land by early farmers, at least from Indiana to Iowa. It included the lower-lying areas of big bluestem, other more hydrophytic prairie grasses, and slough grass, sedges, rushes, and similar plants. It was distinguished from other unwooded areas as being too wet to cultivate. The extent and distributional pattern of the wet prairie within the county cannot be determined accurately, now. However, as presented elsewhere,² the detailed modern-type system of soil classification and soil mapping used by the United States Soil Survey seems to provide the best basis for the determination of distribution and

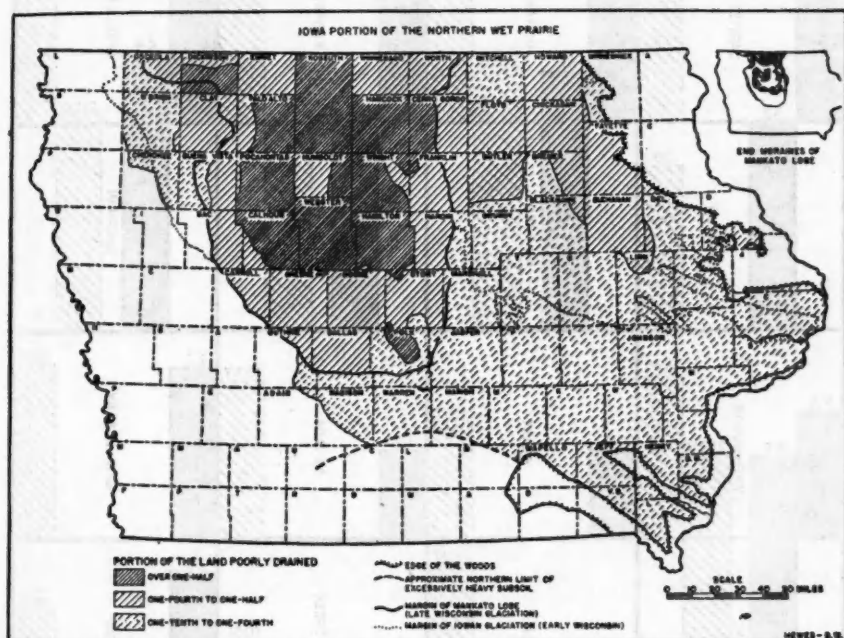


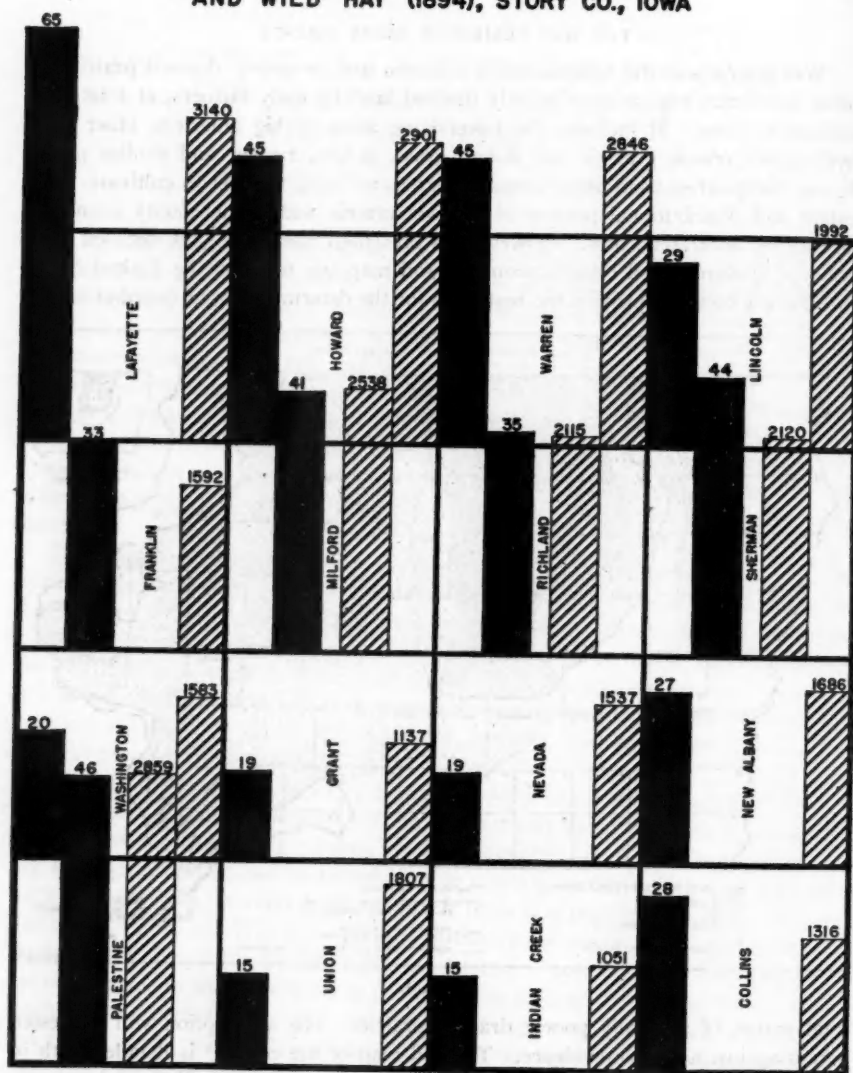
FIG. 1.

total extent of naturally poorly drained prairie. The assumption will be tested herein against available evidence. The soil map of the county³ is detailed both in number of types recognized and minuteness of areas shown. The poorly or imperfectly drained soils of the prairie and marshes (Webster, Lamoure, Bremer, peat,

² Leslie Hewes, "The Northern Wet Prairie of the United States: Nature, Sources of Information, and Extent," *Annals of the Association of American Geographers*, XLI, 4 (1951): 307-323.

³ As contained in H. R. Meldrum, D. E. Perfect, and C. A. Mogen, "Soil Survey of Story County, Iowa," *Soil Survey Series*, 1936, No. 9.

WET PRAIRIE AND WILD HAY (1894), STORY CO., IOWA



BLACK BARS: WET PRAIRIE PERCENTAGE (APPROXIMATE)

LINED BARS: WILD HAY ACREAGE

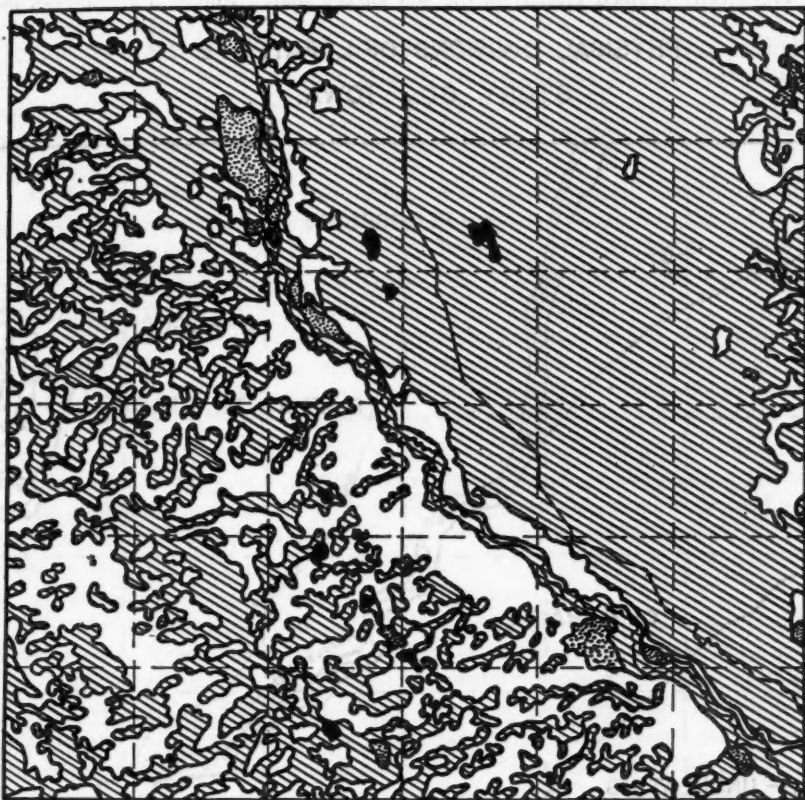
NOTE: HEIGHT OF BARS DRAWN SO THAT AVERAGE BAR
REACHES NORTH EDGE OF TOWNSHIP





AVERAGES: WET PRAIRIE - 33%

WILD HAY - 2012 acres

FIG. 2.

CONDITION OF DRAINAGE IN LAFAYETTE TP.,
STORY CO., IOWA



SYMBOL	CONDITION OF DRAINAGE
1 	EXCESSIVE
2 	GOOD
3 	POOR
4 	VERY POOR

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FIG. 3. The poor drainage represents Webster prairie soils and some bottom land. The areas of very poor drainage are peat and muck.

and muck) comprise about 35 per cent of the total area of the prairie portion of the county (or 33 per cent of the area of the county), but the distribution is uneven. Figure 2 represents the approximate percentage of each township shown as poorly or imperfectly drained prairie on the soil survey map. Figure 3 exemplifies the

**PHYSICAL DIVISIONS OF LAFAYETTE TP.,
STORY CO., IOWA.**

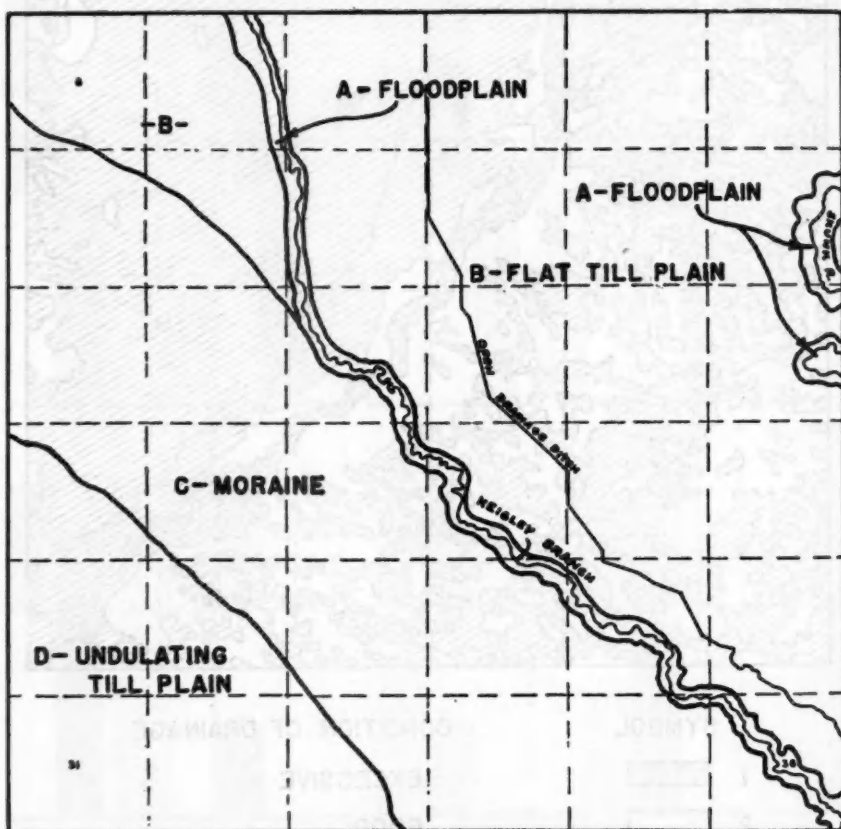


FIG. 4.

FRANDSON

three chief distributional patterns of wet land in central and northern Iowa. Within Story County, the pattern of small, discontinuous wet tracts intermingled with well-drained land is the general rule except in the northeastern one-half of Lafayette Township, where the one extensive continuous poorly-drained prairie portion of the

county is found. The small, discontinuous poorly drained areas vary from kettle-holes in recessional moraine to incipient drainage ways in the slightly dissected drift. The large poorly drained area in the northeastern portion of Lafayette Township is so nearly flat that in the early soil survey it was considered of lacustrine origin.⁴ Actually, the surface is not entirely flat. Small round or oval basins of a few feet depth with slopes up to 3 per cent and winding incipient drainage ways lie slightly below the general level. The third type of pattern of poor drainage is the valley bottom, which is in part wooded rather than prairie. A comparison of Figures 3 and 4 shows a close correspondence of the patterns of drainage condition with land form regions.

Confirmation that much of Story County was actually wet land at the time of its early settlement is abundant, but mainly of a subjective character. However, the United States Land Survey party seems to have noted carefully the location of especially wet spots in the four northeastern townships of the county. Township plats⁵ made from their field notes show 103 ponds or swamps in the 140-odd square miles contained. Since observation was limited to section lines and their immediate vicinity, many ponds and swamps in the surveyed area were not observed. However, the thoroughness of the reporting of especially wet land is attested by the fact that of the peat or muck areas located on section lines as mapped on the soil survey map of 1936, the surveyor failed to note only two. Of the 103 ponds and swamps recorded by the surveyors, fifteen appear as peat or muck on the modern soil map and the remainder are mapped as areas of Webster or other poorly drained soils. Far more areas of Webster soil crossed by section lines were not noted than were noted by the surveyors, suggesting, perhaps, that the water did not in many instances extend far enough up their boots to require notice.

The reminiscences of old settlers contain numerous direct and indirect references to poor drainage in the county. Three pertinent references follow: "In the year 1865, on arriving at Nevada . . . we started across the country northeast. . . . Everything looked like a great lake; not a house within six miles of town. Winding our way through water until we arrived at Johnson Grove"; the first public road in Howard Township "meandered between the ponds and sloughs"; and ". . . we had to pick our way around ponds and across sloughs" [in going from Warren Township to the town of Nevada in 1875].⁶ It should be noted that the soils near Nevada, in the central part of the county are mainly members of the Webster series and that both Howard and Warren townships contain numerous small areas of that series. An early settler is quoted as saying that enroute to the

⁴ Herbert W. Marean and Grove B. Jones, "Soil Survey of Story County, Iowa," *Field Operations of the Bureau of Soils*, 1903. p. 845.

⁵ T. 85 N., R. 22 W.; T. 85 N., R. 21 W.; T. 84 N., R. 22 W.; and T. 84 N., R. 21 W., all from the Fifth Standard Meridian. Township lines were surveyed in November, 1846; subdivisions, in June and July, 1847.

⁶ *Atlas of Story County, Iowa* (presumed title; title page lost). The Huebinger Surveying and Map Publishing Co., Davenport, Iowa, 1902. Pt. 1, first reference on p. 4, other on p. 3.

county, he was informed "that Story was the wettest county in the state."⁷ Although the wetness of the county was exaggerated, it was, as Figure 1 shows, wetter than any county to the east or southeast on the usual lines of approach.

Even as late as 1903, it was reported authoritatively that "low knolls are separated by saucerlike depressions, in which empounded water often stands the year around. In many cases these low-lying areas have been reclaimed by artificial drainage, but in the main rainwater which falls upon the uplands has to escape by seepage or evaporation. Little ponds and marshes are found in almost innumerable places scattered all over the county."⁸ It should be noted that the description just given was made after the drying-up effects of civilization due to cultivation, grazing, road building, and, in later years, to tile drainage had been going on for some fifty years, and after the entire county had been closely settled for nearly two decades. The sloughs by that time must have been only a fraction as numerous, large, and deep as those found by the earliest settlers. For example, the roads as shown on the soil map of 1903 no longer meandered. At present, very few sloughs contain water throughout the year.

TABLE I
Productivity Ratings of Chief Well Drained and Poorly Drained Prairie Soils

	Area	Corn	Oats	Clover and timothy
Chief well drained prairie soils				
Clarion loam	41.5%	85	90	100
Clarion fine sandy loam	9.2	60	70	75
Chief poorly drained prairie soils				
Webster loam	8.5			
undrained		50	40	50
drained		100	95	100
Webster silty clay loam	20.9			
undrained		45	35	50
drained		100	80	90

Adapted from Table 6, Meldrum, Perfect, and Mogen, "Soil Survey of Story County," 1936.

The productivity ratings in Table I show how poorly adapted to crop farming the chief poorly drained prairie soils were in 1936, even after general lowering of the water table. Earlier, the same soils were probably wetter and even less capable of cultivation. In 1936, five of seven minor poorly drained prairie soils were given zero ratings if without artificial drainage.

Of 23 farms of the 1850-1860 period whose location on the prairie could be determined, only one was located chiefly on Webster soil,⁹ and it was largely on the lighter, loam member. The avoidance of the areas of Webster soils by the early settlers finds ready explanation in the assumption that such areas were largely too wet

⁷ W. O. Payne, *History of Story County, Iowa*, Vol. I. S. J. Clark Publishing Co., Chicago, 1911. p. 157.

⁸ Marean and Jones, *op. cit.*, p. 836.

⁹ Leslie Hewes, "Some Features of Early Woodland and Prairie Settlement in a Central Iowa County," *Annals of the Association of American Geographers*, XL, 1 (March, 1950): 50.

for successful farming. Although it is true that the prairie near the streams is considerably less wet than in the county as a whole, the statistics of early farm location support the conclusion that the areas of Webster soil were actually wet at that time.

On the basis of several lines of evidence, the conclusion is advanced that at the time of settlement, the soil areas of poor or imperfect drainage as mapped in the 1936 soil survey were actually largely too wet for successful cultivation. Accordingly, it must be concluded that about one-third of the Story County prairie must be classed as naturally wet prairie, including swamp.

OCCUPATION OF THE WET PRAIRIE

Because of the intricate interfingering of areas of good and poor drainage in most parts of the county, most farms included some poorly drained prairie land,

TABLE II
Land Use by Townships in Story County, 1874

Townships	Land in farms acres	Improved land acres	Cultivated land acres	Corn acres	Wild hay tons
Collins	15006	8961	7486	3364	1888
Franklin	14209	10769	7326	4223	1947
Grant	10417	10417	5730	2586	2575
Howard	14634	14634	7734	4723	4395
Indian Creek	16999	14214	9492	4878	2467
Lafayette	9598	6761	4003	2247	3021
Lincoln	6684	4163	3866	1323	1030
Milford	12904	10752	6516	3724	3804
Nevada	14670	12776	7637	3570	2779
New Albany	12319	10964	7070	2889	2083
Palestine	15145	10092	5034	3449	3507
Richland	10221	4708*	5949*	2486	1863
Sherman	6264	3394	2751	1074	1011
Union	16359	13410	9901	4692	3894
Warren	2055	1107	814	333	435
Washington	14040	13376	8078	5706	2860
County totals	192,523	148,649	99,387	51,273	39,554

* Error in either improved land or cultivated acreage, probably the former.

Source: *Iowa Census of 1875*.

The names of the wetter townships are italicized. All townships contain approximately 36 square miles.

even from the first decade of settlement. Nineteen of the thirty-five sites of the 1850-1860 period whose locations were determined contained mapped areas of Webster soils.¹⁰ Inevitably, as settlement was extended onto the interfluvies the percentage of wet land in farms increased and in many instances comprised the chief land type of the farm.

Despite the number of variables involved, including accessibility of timber, nearness to railroads, as well as amount and distribution of wet land, census data by minor civil divisions are of considerable utility in indicating the degree to which the wetter portions of the county were avoided because of their wet condition.

¹⁰ *Ibid.*

A comparison of Table II and Figure 2 shows that in 1874 most relatively wet townships ranked low in land in farms, were low in amount of improved land, and were below average in amount of cultivated land. Four of the five townships leading in the production of wild hay were comparatively wet townships (Howard, Milford, Palestine, and Lafayette). (Here, the argument is that wild hay was probably the most productive use of wet prairie land.) In contrast, the drier townships led in land in farms and were well above average in amount of cultivated land. Chief exceptions were Grant, a comparatively dry township, which lagged in development, and Lincoln, a little less wet than the average, which likewise lagged. In the latter case, however, tardy development can be explained largely on the basis of unfavorable location in respect to timber and early railroads. Also, the same explanation holds for the tardy development of "wet" Warren Township.¹¹ The preponderance of evidence of land use variations by townships in 1874 supports the conclusion that the existence of large amounts of wet prairie constituted a significant limitation to early agricultural development of the wetter portions of Story County.

The delay in the occupation of the wet prairie might have been longer but for the fact that groups of settlers familiar with wet land and its problems may have speeded settlement and agricultural development considerably in three of the wettest townships of the county. In Howard, Lafayette, and Palestine townships, Norwegians were included among the edge-of-the-woods settlers as early as 1860. Three of a total of twenty-one names of the pioneers of the period listed by a non-Scandinavian pioneer as living on the Lafayette Township side of Skunk River were Scandinavian and of the twenty reported residing on the east side of the river in what is now Howard Township, four were Scandinavian.¹² The United States Census of 1870 showed over one-half of the population of both Howard and Lafayette townships and over one-third of the population of Palestine Township as foreign born. In no other township was the number or proportion of foreign-born population as large. Perhaps it is significant that Sherman Township, which was less wet than Howard, Lafayette, and Palestine, and which was closer to the railroad and with timber nearly as accessible, but was without a Norwegian community, lagged in development, as shown by the Iowa Census of 1875 (Table II).

Both Howard and Palestine townships were chosen for Norwegian settlement by committees looking for cheap land.¹³ Wet prairie was doubtless the cheapest land available.

Although at the outset it was not necessary for the Norwegians to settle on mainly wet prairie, with the filling up of the land eventually little but wet land was left for the later arrivals. In the case of Lafayette Township, even a moderate expansion of settlement away from the edge-of-the-woods location of earliest settlement brought the Norwegians onto the most extensive area of wet prairie in the

¹¹ *Ibid.*, pp. 51-54.

¹² *Atlas of Story County*. Pt. 1, p. 6.

¹³ Payne, *op. cit.*, p. 23, and James A. Storing, "Palestine Settlement," *Palimpsest*, XXI, 5 (May, 1940) : 151-156, respectively.

county. Conceivably, the difficulties involved restricted Norwegian expansion in that direction, with the result that the better drained lands in the western portion of the township were occupied by other groups. In contrast, the Norwegians spread throughout somewhat less wet Howard Township, and on beyond into Warren Township, also quite wet, which was the last township in the county to be settled. In both townships, most wet areas were smaller than the size of an average farm. The expansion from the early Norwegian settlement in eastern Palestine Township resulted in Norwegians being found throughout Palestine Township and extending into the southwestern, wetter portion of Union Township, as indicated by plats of land ownership.

During the 1870's, according to local information, a colony of Danes settled on a portion of the big wet prairie of eastern Lafayette Township at about the same time that Norwegians were occupying other portions. By 1880, the Danes formed a solid block of settlement, called the Copenhagen community, in the south central part of the wet land. At a somewhat later date, the Danes occupied the wet land in the extreme northwestern corner of the township.

The fact that it was possible to form a new Danish community several square miles in extent on the flat till plain of eastern Lafayette Township within a short distance of timber and near one of the areas of earliest settlement in the county suggests the degree to which the big wet prairie had been avoided. The vacancy of the area is suggested by the testimony of a son of one of the Danish pioneers on the wet prairie who related, "Father often told how he was criticized and razzed by friends and relatives on the river for daring to buy land so far from civilization, so far from timber, neighbors, and roads."¹⁴ The present-day distribution of Norwegians and Danes within the township, although not precisely that of 1880, is evidence of the permanence of their settlement and implies successful occupation of land which had been avoided through the first twenty or twenty-five years of settlement in the county. The fact that old settlers recall that a few squatters were living on some of the less wet spots only emphasizes the low esteem in which the big wet prairie was held at the time of the Norwegian and Danish settlement.

Statistical data relative to the distribution of Norwegians and Danes in Story County in 1885 appear in Table III.

It is in order to note that Norwegians had been present for a quarter of a century in the older centers, resulting in the census data for foreign born population under-representing the population of Norwegian origin.

Excepting Union Township, which is not a wet township, but had Norwegian settlers, and Sherman which is a wet township, but had no Norwegian settlement, the Norwegians were settled in the wettest townships in the county, and the Danes were concentrated in the wettest single township of the county. A fundamentally more favorable point-of-view toward wet land on the part of these Scandinavian settlers than of the other groups who settled in the county is implied strongly. Other

¹⁴ J. H. Frandsen, in *Story City Herald* Anniversary Number, 1940: 47.

groups who settled the county were Pennsylvania Dutch, and other old-stock Americans, especially from such states as Indiana and Ohio, and Germans.

PRE-DRAINAGE LAND USE

Although as an early settler put it, "only the higher laying lands could be broken,"¹⁵ wet prairie land was necessarily included in most prairie farms. The wet areas, if used at all, served for pasture or wild hay, or for open range grazing into the 1880's. Early census figures indicate the production of enough wild hay to make it apparent that wild hay was second to corn among the crops of the prairie. If it can be assumed that wild hay (largely big bluestem with probably some slough grass from the wetter areas) yielded approximately one ton per acre, the hay acreage in the county was in 1874 about three-fourths as great as that in corn. Using

TABLE III
Norwegian and Danish Population in Story County, 1885

Townships	Born in Norway	Born in Denmark	Total foreign	Total population
Howard	500	0	527	1,190
Lafayette				
without Story City	150	123	311	920
Story City	229	62	299	595
Milford	131	27	206	751
Palestine				
without Sheldahl	465	11	496	1,201
Sheldahl	63	6	76	164
Union				
without Cambridge	117	0	138	894
Cambridge	55	0	85	473
Warren	165	18	208	590
Other townships	182	148	1,127	10,527
Story County Totals	2,057	415	3,473	17,527

Source: *Iowa Census of 1885*.

the same assumption, the acreage of wild hay was greater than the corn acreage at that time in four of the six especially wet townships and in the other two there was near equality (Table II). This was a period of emphasis on cattle. Oats, which were the second most important cultivated crop after 1880, were even less well suited than corn to growth on the wet portions of the prairie.

To a marked degree the numerous sloughs broke most farms into a disorderly group of patches. As late as 1903, after much drainage had taken place and larger fields had been formed, it was reported, "It is easy to see that this [undrained area] is a great detriment to the farmer, not only because of the land kept out of cultivation, but because it seriously interferes with systematic cultivation to have a field broken up into patches."¹⁶ It should be added that not only small and irregular fields resulted from the presence of wet prairie, but that fields tended to be perma-

¹⁵ *Atlas of Story County*. Pt. 1, p. 6.

¹⁶ Marean and Jones, *op. cit.*, p. 847.

ment and to remain in cultivation rather than to be included in a rotation scheme with planted hay crops, since the wet areas could supply a sufficient amount of hay. Neither tame hay nor rotation pasture was important until after artificial drainage had become general. It is probable that the well drained prairie soils (chiefly Clarion) were damaged considerably by the unscientific cropping.

By 1894, after the emphasis on cattle had been reduced and after a beginning had been made on artificial drainage, the acreage in wild hay in the county, although nearly as great as in 1874, was only slightly over one-fourth as great as the acreage in corn, and was exceeded both by that in pasture and oats, although it was still greater than that planted to tame hay. According to the 1895 Census of Iowa, the acreages of chief farm land uses were: corn (both for grain and stalks), 124,091; pasture 75,378; oats 55,569; prairie hay 32,220; and timothy and clover (total) 15,264. Wild hay distribution in 1894 may be considered a good indicator of wet prairie because settlement was mature and only limited drainage had taken place. As shown in Figure 2, most of the wild hay acreage was located in the wettest townships of the county, although by no means all of the originally wet prairie was used for that purpose, although probably most of it was still wet. Only in especially wet Lafayette did the wild hay acreage exceed the acreage in oats and only in well drained and long-settled Indian Creek was the wild hay acreage less than that in tame hay.

DRAINING THE WET PRAIRIE

The time, method, and extent of the draining of the wet land in Story County can be determined, if not in detail, at least in broad outline. Probably the thinking of the farmers of the area relative to drainage is indicated correctly by the following statements, "He [the pioneer] picked the pieces of land that were better drained. When these were gone, he picked others not so well drained, but nevertheless picked them because they were cheap . . . but it was not along until toward the latter nineties that the idea became prevalent that, where practicable, it was cheaper and better to drain lands already in possession and fit them for satisfactory tillage than to buy more lands and manage them in the way cheap lands are wont to be managed."¹⁷ Periods of high prices of farm products of the area were times of unusual drainage activity.

It was claimed in 1890 that the county was much less wet then than ten years earlier.¹⁸ Perhaps plowing of land and construction of roads contributed significantly to the change, but some drainage by tiling had been effected. The Iowa Census of 1895 verifies the fact that a considerable beginning in drainage had been made by that time. It was reported that there were 408,792 rods of drainage tile in use in the county, of which 49,566, or roughly one-eighth, were laid in 1894.¹⁹ Ac-

¹⁷ Payne, *op. cit.*, pp. 19, 21.

¹⁸ *Bibliographical and Historical Memoirs of Story County, Iowa*. Goodspeed Publishing Co., Chicago, 1890. pp. 118, 119.

¹⁹ Excepting Hamilton County, for which the census reported a fantastic figure, more tiling had been done in Story County than in any other county within the Mankato Lobe. Most drainage had been done in the longer settled but less wet counties to the east and southeast.

cordingly, it is reasonable to suppose that a considerable part of the tile reported in 1895 was installed during the 1880's. Tile was the only drainage device reported at the time.

Applying the locally used rule-of-thumb, presumably for Webster silty clay, which is the most common poorly drained soil, that tile will "draw" water one rod on either side for every foot it is buried, and assuming that tile was generally at a depth of about three feet, sufficient to provide considerable benefit, the amount of tile reported drained about 15,000 acres, or about 6 per cent of the area of the county or less than one-sixth of the area previously assumed to have been poorly or imperfectly drained. Since it is likely that much of the tile was smaller and buried less deeply than is the present practice, it is probable that actually less than 15,000 acres were well-drained by the tile reported, although considerably more was probably benefited and may have been considered to have been drained.

Although the location of the tile by minor civil divisions was not reported, it is reasonable to suppose that most of it was laid in the longer settled areas and in the immediate vicinity of streams which could serve as outlets for the tile. A pioneer of Collins Township was quoted in 1902 as saying, "but cultivation and artificial drainage have reduced these [ponds] very fast, until now there is no waste land in the township. There are enough natural streams running through the township to make very convenient outlets for tile."²⁰ At the same time, a resident of the county since 1871 stated:

"Thirty years ago the county was regarded as among the least desirable in the state; in as much as a large part was low and swampy, and the assertion was often made that such land was valueless and would only be fit to raise ducks on or in; being then readily bought at from three to six dollars an acre. The same land now selling at from fifty to seventy-five dollars, largely due to the system of tilling [tiling?] which makes the most productive in the county."²¹

The Story County Atlas (of about 1902) showed, however, a number of large swamps remaining, especially in Lincoln, Warren, and Milford townships. Most of the big wet prairie of Lafayette Township remained undrained. According to local information, the first tiling along its edges took place about 1895, whereas tiling began on the higher land overlooking it on the southwest in 1886.

In 1903, the county situation in respect to completeness of drainage was reported thus, "A great deal has been done in the way of tiling and ditching. Most of the farms of the upland are equipped with a system of tile drains more or less complete and effective, but there is ample room for improvement."²² For the big wet prairie of Lafayette Township, the report was,

"In the upland or lacustrine phase [of what was then called the Miami black clay loam] conditions are generally too wet for the production of good yields. At present this soil is best fitted for hay production and grazing, and it is largely used for this purpose. If more ditches were dug to furnish outlets for the tile lines and the land could be thoroughly drained, much of the soil could be greatly improved and fitted for the production of large crops of grain."²³

²⁰ *Atlas of Story County*. Pt. 1, p. 5.

²¹ *Ibid.*, Pt. 1, p. 8.

²² Marean and Jones, *op. cit.*, p. 847.

²³ *Ibid.*, p. 846.

The big wet prairie of Lafayette Township remained wet longer than most of the wet prairie of the county, largely because adequate natural outlets for tile existed only on its edges and because not only additional expense but cooperation between land owners was necessary for the extension of tile lines or ditches to distant streams.

If drainage came later to Lafayette Township than to most of the county, it follows that in the time when Lafayette lagged in drainage that its land use probably differed from that of most of the county. This was true. According to records of the County Assessor, wild hay in 1900 occupied nineteen per cent of the farm land of the township, whereas the United States Census of the same year showed only four per cent of the county in wild hay.

Although the Iowa Census of 1895 seems to contain the only census record of the amount of drainage tile laid in the county, the state census ten years later recorded the value of drainage tile manufactured in the state during the period intervening. From a value of under \$300,000 in 1895 and 1896, the yearly production advanced to over \$500,000 in 1901, and in both 1902 and 1903 exceeded \$1,000,000. Assuming that the state trend applied to Story County, wet land was being reclaimed at a much more rapid rate after the turn of the century than before.

A former officer of the largest tile factory in the county reports that comparatively little tile was sold before 1900, but that sales increased until 1907, declined until 1910, but again increased thereafter and remained high through World War I. Sales again mounted after 1938, and reached a maximum during the years 1944-1949.

In 1920, according to the United States Census of Drainage, 197,633 acres in the county had artificial drainage, amounting to about sixty per cent of the total area of the county, whereas less than forty per cent of the area of the county appears to have been wet. This type of discrepancy is common in both Iowa and Illinois and probably is to be explained as a result of effort on the part of corn growers to "lengthen the season" by providing additional drainage on land of moderately good natural drainage or to guard against unusually wet seasons. Also, it is probable that the amount of land actually well drained by tiling is commonly exaggerated by the farmers, who in the main do not know the amount or location of tile installed on the farm. A slightly smaller acreage of drained land reported for the county in 1930 than in 1920 may mean little other than that the farmers may have estimated the amount of land drained somewhat more conservatively in 1930 than earlier. No over-all statistics of drainage have been published since 1930.

Large scale drainage, including the reclamation of most of the extensive areas of wet prairie, became feasible with the enactment of legislation in 1904 which facilitated the securing of outlets by legally recognized drainage districts, further strengthened by an Iowa constitutional provision in 1910.²⁴ Prior to 1904, only two drainage districts were organized in the county; the total was twenty prior to

²⁴ For the legal background of the organization of drainage districts see Jay J. Sherman, *Drainage Districts in Iowa. A Study in Local Administration*. Ph.D. Thesis, State University of Iowa, Torch Press, Cedar Rapids, 1904.

1910. From 1910 to 1919, seventy-five were organized, or three-fifths of the districts now (September, 1950) in existence in the county. Eighteen of the 125 enterprises are joint districts, partly in Story County, partly in neighboring counties.

COUNTY ESTABLISHED DRAINAGE DISTRICTS

LAFAYETTE TOWN, STORY CO., IOWA

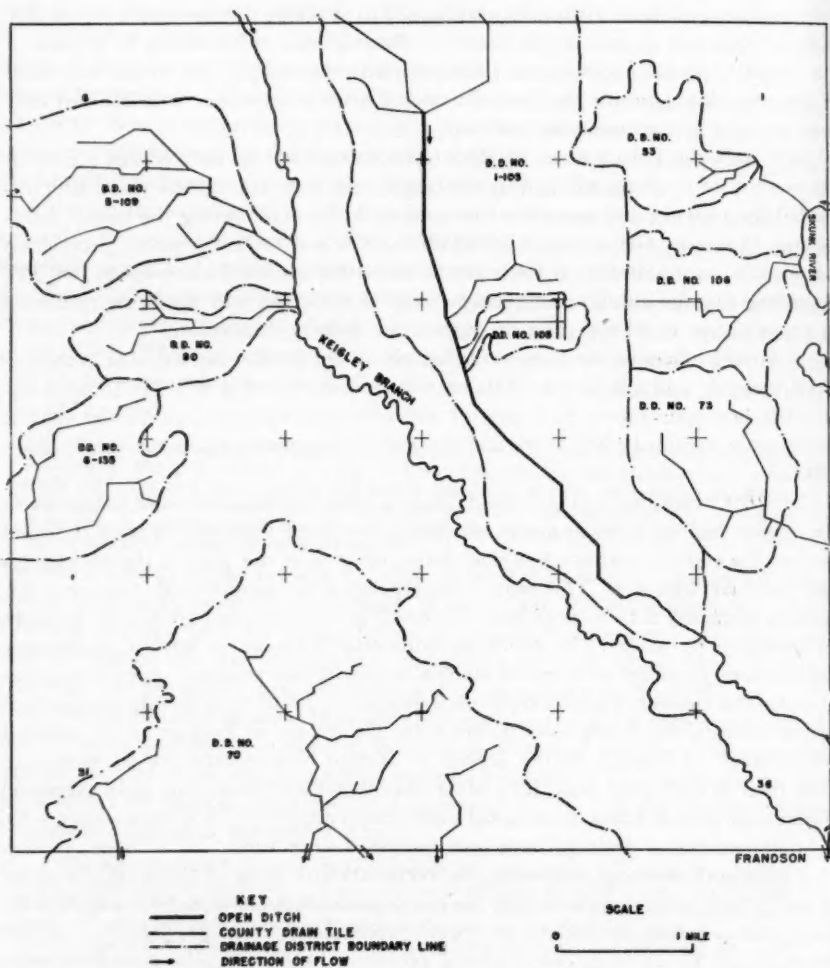


FIG. 5.

Five of the districts were organized after 1940, but most of the ditches and large tile lines, the framework for the most extensive drainage in the county, were dug between 1910 and 1920. Earlier, small, piecemeal drainage had taken place; sub-

sequently, elaboration, largely by individual farmers, of drainage begun by the enterprises has taken place.

On the big wet prairie of Lafayette Township the first drainage district organized, Hamilton Co.-Story Co. District 1-105, was developed about a shallow intermittent stream, which was deepened by ditching to provide a suitable outlet for farmers' tile. Into it, as shown on Figure 5, several large county-operated tiles lead, as well as numerous tile lines installed by the landowners of the district. The district, organized in 1910, was the first in the township.

The nine drainage districts of the township organized in the period from 1910 to 1921, inclusive, embraced roughly sixty per cent of the area of the township, including most of the land distant from streams. Most of the wet land adjacent to

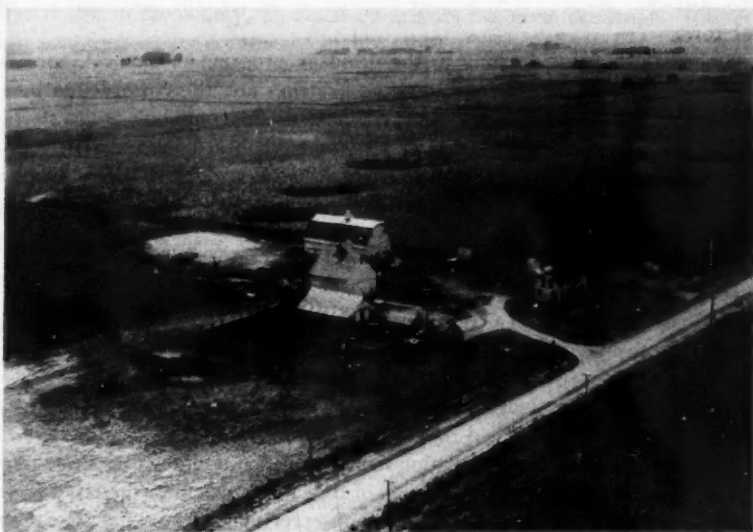


FIG. 6. Aerial summer view of a portion of the flat till plain of Lafayette Township after the wet spring of 1947. Drowned-out spots in the corn are evident despite the land being ribbed by tile drainage lines.

streams, it may be assumed, was drained before the organization of drainage districts, but most land now drained in the township was drained between 1910 and 1921 and followed the organization of districts.

So nearly complete was the drainage of the wet prairie of Lafayette Township by 1925 that the assessor's records showed only one and four-tenths per cent of the farm land of the township still in wild hay. According to local opinion, every farm within the township now contains some tiled land. The last farm to be without drainage was tiled in 1943 (Fig. 10). Some wet spots remain in the township and the tile lines are still being extended. It is admitted that the tile systems of most farms are inadequate for especially wet seasons (Fig. 6).

In comparison to somewhat over sixty per cent of Lafayette Township in drain-

age districts, the county figure is slightly over forty per cent. Local residents estimate that at least seventy-five per cent of Lafayette Township is drained; the census figures of 1920 and 1930 show about sixty per cent of the county as drained. Although not all the land in drainage districts is actually drained, it is probably that as much drained land is included in drainage districts as is outside them in the county and that far more of the drained land is included in drainage districts than not in Lafayette Township.

It appears that in lateness of drainage and in dependence on organized districts, Lafayette Township resembles the originally wet counties to its north, although much of the rest of the county resembles the area of more adequate natural outlets to its east and south in being somewhat earlier in drainage and less dependent on organized districts. Most of the drainage districts of the state lie in central and north central Iowa.

The chief purpose of ditching in the drainage program of Story County is to provide suitable outlets for the tile systems. Ditches are, therefore, found in areas poor in incised stream valleys. If tile of moderate size (commonly up to thirty-six inches in diameter, although tile up to forty-eight inches diameter is used in the county) will serve as outlets, they are substituted for ditches. Thus, in Story County even main drainage lines of drainage enterprises as well as the installations of individual farmers are chiefly tile rather than ditch.

As suggested by a comparison of Figure 5 and Figures 9c and 10c, most of the tile used in the area was paid for and installed by the farmers themselves. On the 348 acre farm on the flat till plain mapped in Figure 9, the tile laid by the owner is estimated at twelve miles, and consists chiefly of tile of eight to ten inches diameter for outlets and of five and six inches for laterals. There may well be over five hundred miles of drainage tile in the township of thirty-six square miles, of which drainage districts installed thirty-four miles of main tile, in addition to four miles of ditch. Other public installation includes tile along highways. The tremendous effort made to overcome the wetness of the land is not immediately evident on the surface and it is not obvious to the casual observer that the land has been drained.

The chief advantages of the use of tile over ditches are: 1), no land is taken out of productive use; 2), the use of machinery is easier; 3), field patterns are more flexible; 4), the costs of maintenance are much lower even though some tile may become clogged; and 5), in sloping areas, the erosion that might result from ditching is avoided.

The costs of tiling are fairly high, and in Story County were for several decades greater than the value of the land. When it is realized that the costs of drainage have varied only slightly over the years, it is apparent that with greatly increased land value and prices for agricultural products, drainage which was economically out of the question at the start may be very profitable today and that land already capable of growing a crop may be drained with profit now.

Although no information on the cost of drainage in the beginnings of reclamation in the county or state is at hand, it is perhaps pertinent to note that the United States Census of 1860 contains a reference to drainage being considered feasible in

New York at a cost of twenty to thirty dollars per acre.²⁵ In a survey of drainage conditions in Iowa in 1903, a cost of twenty-five dollars per acre was assumed.²⁶ For assessment purposes, the Federal Land Bank appraises tile in Lafayette Township in terms of cost at thirty-five dollars per acre on an average. Remarkable consistency in the cost of tiling over the years is indicated by the data.

Even in the county drainage enterprises, most drainage costs are individual rather than collective. The financing of the collective aspect of the county drainage enterprises has been based on taxes levied on the land included within the enterprises. The increased assessment because of drainage is in proportion to the benefits derived from drainage, as determined by a commission. Failure to pay drainage taxes results in public sale of the land. During and since the period of maximum drainage in the county, no drainage district has gone bankrupt. Rather, the drainage enterprises are considered highly remunerative investments.

RESULTS OF DRAINAGE

As a result of the long continued drainage endeavors, the wet prairie of Story County has been almost entirely eliminated. Very little of the county is wet, hardly any of it is native prairie, and little is in permanent grass of any kind. Sloughs, malaria, meandering roads, waste land, wet pastures, and wild hay have disappeared in the process of drainage. The major portion of formerly wet prairie and well drained prairie alike is now cultivated crop land.

As late as 1884, the cultivated land of the county amounted to slightly less than forty per cent of the total area; now, not including rotation pasture, the cultivated acreage amounts to seventy-five per cent. The comparison with 1884 is significant first because very little drainage had taken place before 1884, and second, settlement was mature by 1884, as shown by the following facts: the number of farms was somewhat greater than now, land in farms was five-sixths as large as now, and virtually all parts of the county were well peopled. There is good reason to think that without artificial drainage, the increase in crop land would have been much less.

Some pertinent direct testimony of the changes in crop acreage which followed the organization of drainage enterprises may be cited. The statistics in the 1930 Census of Drainage show that of the 155,253 acres included in organized districts within Story County, 152,628 were then capable of raising normal crops, whereas at the time of the organization of the enterprises (mainly after 1910) only 97,536 were capable of raising normal crops. The addition of over 50,000 acres of normal crop land on drainage projects within a period of little over twenty years was almost equal to the increase in grain acreage in the county within that period. The increase in land capable of producing normal crops was made up of almost equal amounts of land which at the creation of the enterprises had been too wet to produce any crop and of land capable of producing only a partial crop.

In addition to the major increase in cultivated land made possible by drainage,

²⁵ *Census of Agriculture*, p. VIII.

²⁶ W. H. Stevenson and G. I. Christie, "Drainage Conditions in Iowa," *Iowa State Agricultural Experiment Station Bulletin* 78, May, 1904.

important changes in crops grown, cropping systems, and field patterns have resulted. Table IV is a comparison of land use in Story County in 1884 and 1947.

Aside from the marked increase in cultivated land, the chief changes in land use indicated are 1) the virtual elimination of wild hay, and 2) a marked reduction of waste land. Other less marked changes were 1) the addition of soy beans as an important crop (partly under the impetus of high wartime prices), 2) some reduction of percentage of area in pasture, and 3) somewhat greater relative importance given to oats as a crop, despite mechanization. (The year 1947 was one of high prices for farm products; hence land in hay as shown in Table IV was probably below the ten-year average.)

A systematic rotation of crops which includes green manure, and often a hay crop (usually red clover or alfalfa) and rotation pasture, has become feasible on the formerly wet prairie with the virtual elimination of wild hay. Except for the flood

TABLE IV

Land Use in Story County in 1884 and 1947 as percentages of total county area

	1884	1947
Corn	24	42
Oats	10	20
Tame hay	5	6
Soy beans	—	6
Wheat	1	less than 1
Other cultivated crops	less than one	1
Cultivated Total	40	75
Wild hay	13	less than 1
Pasture	17	15
Waste, towns, & other uses	30	10

Sources: *Iowa Census of 1885* and County Assessor's Report, respectively. The percentage in wild hay in 1884 is only approximate, being based on the assumption of a yield of one ton per acre.

plains, where permanent bluegrass pastures are the rule, rotation or semi-permanent pastures are nearly as common as permanent bluegrass pastures throughout the county. Impermanence of field limits and regularity of field pattern have become the rule. A comparison of field patterns in 1947 with those of 1939 in section four of Lafayette Township, on the flat till plain, showed only six fields of the thirty-four present in 1939 unchanged eight years later, in contrast to the irregular permanent fields which characterized most of the wet prairie as late as 1903, and probably until the drainage initiated by the organized districts about 1910.

Most of the evident differences between the once wet prairie and the naturally well drained prairie have largely disappeared. Figure 7 shows that no one of the three major physical divisions (flat till plain, recessional moraine, and undulating till plain) of the township departed very much from the county average in land use. Essential uniformity in land use regardless of original difference in drainage condition suggests the degree to which the original disadvantages of wet land have been overcome.

As shown in Table I, the chief drained wet prairie soils of the county are given higher soil productivity ratings than the chief well drained soils of the county, particularly for the growing of corn. However, the big former wet prairie of the flat till plain of Lafayette Township does not have higher corn yields than other parts of the township. As calculated from the assessor's reports, the unweighted average

USE OF FARMLAND IN 1947 BY MAJOR PHYSICAL
DIVISIONS, LAFAYETTE TP, STORY CO, IA.

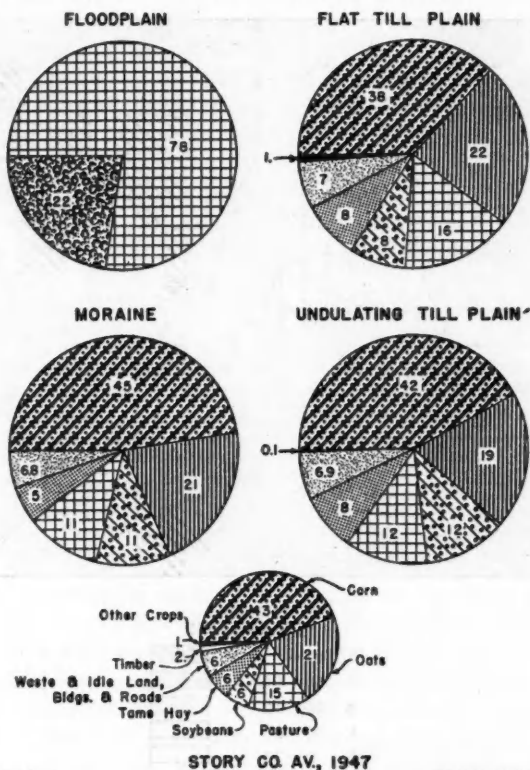


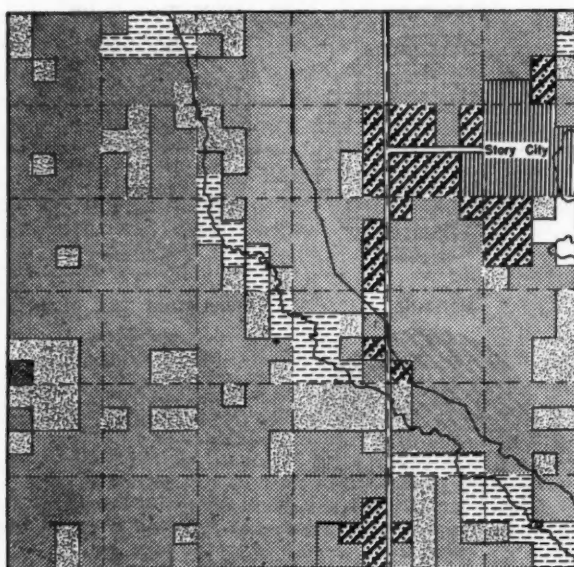
FIG. 7.

FRANDSON

for the farms of the flat till plain for the years 1935-1944, inclusive, was 54.6 bushels per acre as compared to the township average of 55.8 bushels. The discrepancy between the soil productivity ratings and actual average yields tends to confirm the popular opinion that, great though the drainage has been in the chief naturally wet prairie area in Lafayette Township, it is not yet adequate to insure the highest gross returns per acre. The same generalization seems tenable for the county. Although

some farmers admit having "corned" drained Webster soils to the point of reducing the permeability on which tile drainage depends, present use of the drained land differs only slightly from that of naturally well drained soils, and, as is illustrated in Figure 10d, field boundaries are usually drawn without regard to soil types. A minor exception to the generalization that the treatment of artificially drained and

TAX ASSESSMENT EVALUATION PER ACRE FOR 40 ACRE
UNITS, LAFAYETTE TP., STORY CO., IA. AV.-\$55.14



LEGEND
(IN DOLLARS)

- | | |
|----------|--|
| 1. 60- | |
| 2. 55-60 | |
| 3. 50-55 | |
| 4. 30-50 | |
| 5. 0-30 | |

FRANDSON

FIG. 8.

naturally well drained land is substantially the same is the smaller use of lime and greater use of commercial potash fertilizer on some areas of Webster soils, both due largely to the "high lime" quality of some of the drained land.

The once wet prairie is now as highly esteemed as the land of good natural drainage. Figure 8 shows the essentially uniform valuation of land throughout Lafayette Township, whose northeastern one-half constituted the largest area of wet land in the county. The average valuation for taxation purposes in 1945 for

the township was \$55.14 (probably little more than one-fourth the actual market value). Only very limited areas were assessed at less than \$50 or more than \$60 per acre: 1) bottom lands, subject to flooding, along Keigley Branch and Skunk River; 2) sloping lands adjacent to the streams, both of which were assessed at well below the average; and 3) level lands adjacent to the highway or to Story City, which were assessed at more than \$60 per acre.

For the county, as well as the township, it appears that the disadvantage of poor drainage has been generally overcome. The seven townships shown on Figure 2 as having more than the average amount of wet prairie have the following rankings in assessed value of land according to the last (1949) assessments and Iowa crop production index,²⁷ respectively, townships arranged in order of prominence of wet prairie: 1) Lafayette, 1 and 3; 2) Palestine 8 and 10; 3) Howard, 9 and 7; 4) Warren, 3 and 1; 5) Sherman, 2 and 4; 6) Milford, 6 and 6; 7) Richland, 4 and 2. Although other considerations may be fully as important as natural drainage condition, it is notable that most of the wetter townships ranked above the median for the sixteen townships of the county in both assessment value and production record.

An important handicap of the wet prairie in its pioneer condition was the high incidence of malaria. The following testimony of an early settler in Lafayette Township suggests that the disease was considered a normal part of prairie pioneering, "Sickness was almost unknown and what little there was nearly always yielded to the simple home treatment of the pioneer. I will, however, except the ague and fever, which continued with us until most of the prairie had been brought under cultivation, when the disease gradually disappeared, and with it to a great extent, the quinine bottle."²⁸ The wording suggests that at the time, about 1902, malaria had been nearly eradicated, but not entirely. A considerable beginning in the drainage of wet land had been made by that time.

EXAMPLES OF TWO FARMS

Some of the results of the drainage of wet prairie land are epitomized by the changes in land use which followed drainage of two farms in Lafayette Township for which apparently reliable information was found. One farm is located in the flat till plain; the other on the recessional moraine. In the first, the only soils mapped are soils of the wet prairie; in the other, the wet prairie soils occupy less than one-half of the farm. The pre- and post-drainage land use of these two farms will be presented as case studies, giving details of conditions previously generalized from local testimony and county and township census data.

The Arthur Frandson (original family name, Frandsen) farm is situated on the flat till plain. It is included within the old Copenhagen community of Danish settlement, and was occupied a few years before 1880 by the father of the present owner.

The map of land use on the farm about 1900 (Fig. 9b) is based on the memory

²⁷ A system of rating the per acre production of pounds of grains and seeds of all land in farms, computed for the years 1940-1944 in "A Graphic Summary of Crop Yields and Land Productivity by Townships, 1940-1944," *Iowa Department of Agriculture Bulletin No. 925*.

²⁸ *Atlas of Story County*. Pt. 1, p. 6.

of the present owner, whose immediate concern with farm operations has been continuous since that time. The present tile system was put in under his personal supervision. Accordingly, it is not surprising that the location of sloughs and other poorly drained pasture and wild hay fields as mapped by him after the passage of nearly fifty years are generally consistent in their distribution with the tile pattern (Fig. 9c). Even stronger evidence of the accuracy of the location of the sloughs as mapped is the fact that all but one of the eight areas of Webster silty clay (Fig. 9a), the lowest and least permeable soil on the farm, are represented by one or more sloughs. A shift to the north of the large slough in the northeastern part of the farm would eliminate that discrepancy and would also leave all loam areas free of sloughs.

In addition to the silty clay, a considerable portion of the Webster silty clay loam was occupied by sloughs. The area mapped as slough is about sixty-five acres, or nearly one-fifth of the 349-acre farm.

The major part of the farm was considered too wet for cultivation. Some 135 acres are mapped as in wild hay, about 75 in pasture, and about 30 in wild hay or pasture. Cultivated land was shown as limited to about 105 acres; the farmstead occupied about four acres. Some parts of the prairie were used primarily for hay, some primarily for pasture, but occasionally hay might be cut in the pasture and in spring and fall cattle might be grazed for a time on the hay lands, an operation usually requiring herding due to the generally unfenced condition of hay lands. Hay was cut in the sloughs out as far as wetness or quality of the hay would permit. Especial emphasis was placed on dual purpose shorthorn cattle, kept mainly for dairy purposes.

The dominance of pasture and wild hay as mapped is in agreement with the general statement of the soil surveyors made in 1903, which has been cited above, and is consistent with the emphasis on cattle raising then prevailing in the locality.

If, after the occupation of the land for a quarter of a century and some attempt to drain a portion of the land by the original settler, only thirty per cent of the area was sufficiently well drained to be cultivated or to serve as a farmstead, it seems safe to assume that virtually none of the farm other than the limited areas of Webster loam could be counted on as well enough drained to grow crops regularly at the time of settlement.

The dredging of the county drainage ditch through the flat till plain in 1910 so deepened an adjacent shallow intermittent stream as to provide a suitable outlet for tile lines from the farm except during periods of especially heavy rain. Since that time, the tile drainage system mapped in Figure 9c has been put in by the present owner. In several instances small, shallowly buried tile installed by his father were uncovered. The 3840 rods (twelve miles) of tile mapped, mainly three to four feet deep, fall considerably short of the density pattern called for in the rule-of-thumb that tile will "draw" one rod on each side for every foot it is buried below the surface. Much of the loam and some of the silty clay loam is considered sufficiently well drained without tiling, and in the northern eighty acres of the farm,

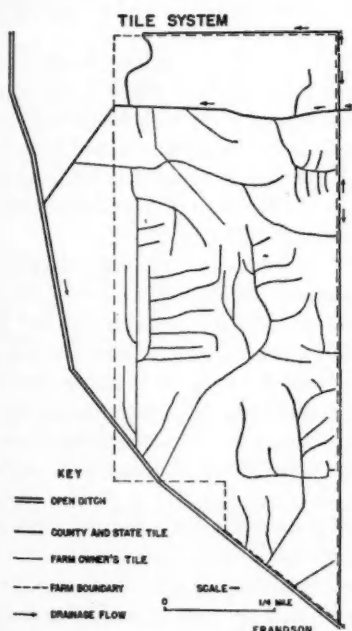
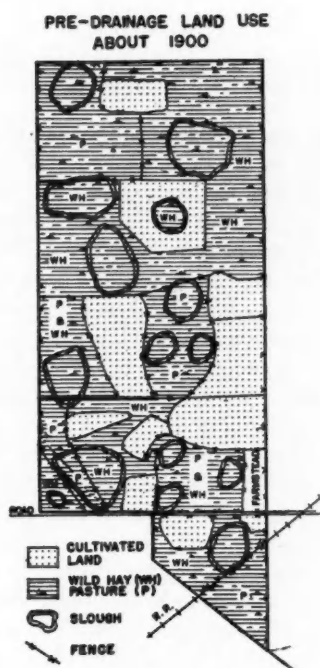
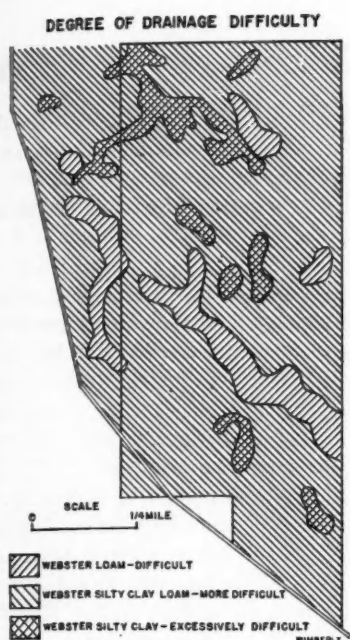


FIG. 9. The Frandson farm includes the east one-half of section 15 and a small part of section 22. Identification of sub-figures: 9a, upper left; 9b, upper right; 9c, lower left; 9d, lower right.

which was purchased after some tiling had been done, no tile is mapped since the present owner does not know its location. The system is considered to be fairly adequate for the average year, but deficient for the rainier seasons.

Current land use is that common through the county. Figure 9d shows the usual crops of corn, oats, hay, and soybeans, as well as bluegrass pasture.

The Posegate farm, the second farm for which reliable data are available, is located in the recessional moraine area and is characterized by a drainage condition pattern of interfingering areas of good and poor drainage. As shown on Figure 10a, based on the equating of soil type and drainage condition, considerably less than one-half of the farm was poorly drained. In this case, the tiling of the farm took place so recently that pre-drainage land use is preserved in the aerial photograph of the locality made in 1939. The farmer was asked to distinguish wild hay from pasture, but otherwise Figure 10b is based on the aerial photograph.

The correspondence between the areas of wild hay and pasture in 1939 with the soils of poor drainage is so close as to leave no reasonable doubt that the soils classed as poorly drained by the soil survey were in fact, even as late as 1939, in large part actually too wet to be cultivated successfully. The native wet prairie species had, however, been largely replaced by bluegrass, except in the wettest spots. The 120-acre farm then consisted of about seventy acres in cultivation and farmstead and fifty acres pasture and wild hay. The situation persisted until 1943 when much of the farm was tiled.

The Posegate farm, which had no tile on it until 1943, is regarded locally as the last farm in the township to be tiled. The owner was able to furnish a map of the tile lines on his farm. (Incidentally, considerable search throughout the township failed to reveal any maps of tile systems other than for the Posegate and Frandson farms, and inquiry at the office of the County Engineer showed that no farmer in the county had taken advantage of the opportunity to file maps of tile systems there.) The tile map for the Posegate farm is shown as Figure 10c.

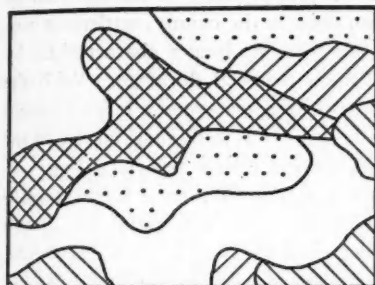
A comparison of Figures 10a, 10b, and 10c indicates that all areas of Webster soils were entered by tile lines and that the densest part of the system is largely in the Webster silty clay, the most poorly drained soil type of the farm; and that all areas which were in pasture or wild hay were entered by tile lines. However, a number of the tile lines extended somewhat beyond the areas of Webster soils and somewhat beyond the limits of the pasture and wild hay. The farm exemplifies a condition common in north-central, central, east-central, and southeastern Iowa as well as in most of Illinois, in which the acreage of artificially drained land exceeds the area occupied by poorly drained soils.

Draining the land resulted in the elimination of irregular fields and permitted the adoption of the usual rotation scheme of the region. By 1947, only one small permanent pasture and one small wild hay meadow remained. Within four years' time, changes in land use were made which in most parts of the county took several decades. The crops shown on the map of land utilization (Fig. 10d) are the important crops of the region, with only soybeans missing.

CONCLUSION

Story County as a southeasterly part of the large portion of Iowa in which wet prairie was common at the time of settlement, in an area in which settlement proceeded from the southeast and east, was one of the first parts of the state in which serious problems of occupying and utilizing the wet prairie were faced. The time

NATURAL DRAINAGE ADEQUACY



ADEQUATE (CLARION) — INADEQUATE (WEBSTER)

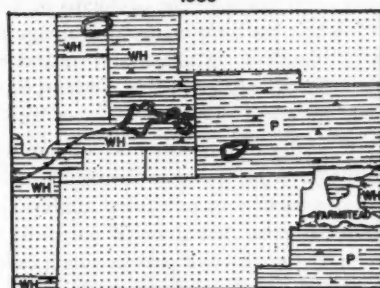
• FINE SANDY LOAM	LOAM
□ LOAM	SILTY CLAY LOAM
	SILTY CLAY

TILE SYSTEM



PRE-DRAINAGE LAND USE

1939



CULTIVATED LAND
WILD HAY (WH) -- PASTURE (P)
SLOUGH

LAND USE AFTER DRAINAGE

1947

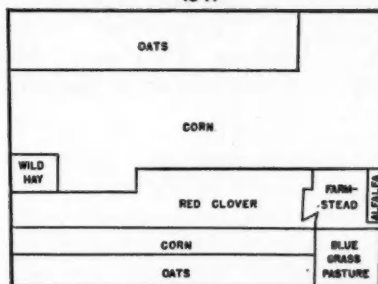


FIG. 10. The Posegate farm is located in the southeastern part of section 20. It contains 120 acres. Identification of sub-figures: 10a, upper left; 10b, upper right; 10c, lower left; 10d, lower right.

has been sufficiently long and the evidence is sufficiently clear to permit evaluation of the wet prairie environment and of the results of its occupation.

For the major portion of the period of white occupancy, poorly drained prairie constituted an important natural limitation to the development of the county. The limitation is evident in 1) some retardation of settlement, 2) the high incidence of malaria during the pioneer period, 3) difficulty of transportation during the early decades, and 4) important disadvantages in land utilization.

For perhaps three decades, it appears, wet land constituted a considerable disadvantage to settlement in the county and limited land use considerably longer. The disadvantage might have been greater than it was but for two considerations: 1) in most of the county, land areas of the size of the average farm included well drained land as well as wet prairie; and 2) settlers already familiar with the problems of poorly drained land pioneered the settlement of three of the wettest townships in the county. These considerations—the spotty distribution of wet land and settlers familiar with the problems of wet land—help to account for the fact that by 1885, when but little artificial drainage had been done in the county, settlement was nearly complete. Malaria and meandering roads were no longer characteristic by 1900. Relatively complete cultivation waited upon artificial drainage. With the nearly complete elimination of wet land from the upland has come a large measure of uniformity in land use and land values throughout. On individual farms, in the wettest townships, and in the county as a whole, the wet prairie has caught up.

The conclusions presented apply to one county specifically, but it seems reasonable to suppose that some, if not most, generalizations have application to a much larger part of the wet prairie which once characterized parts of Illinois, Minnesota, North Dakota, South Dakota, Wisconsin, and Indiana, as well as much of Iowa.

The geographer's task is considered by many modern geographers to be the study of the *differentiation* of the earth's surface, and the role of human activity to be either that of actively modifying the landscape, thus producing differences from place to place, or of emphasizing pre-existing differences already present by adapting human activity to natural environment. However, the results of reclaiming the wet prairie have not been to produce differences or perpetuate them, but, rather, to eliminate most of the previously existing differences between land of unlike natural drainage condition. The changes, important as they are, are not in the main self-evident and have been largely ignored by American geographers.

THE CALIFORNIA-NEVADA BOUNDARY

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A number of states have had serious border disputes, but, to many, it comes as a surprise that any difficulties could arise along the California-Nevada frontier. The boundary was described by a state constitution and never changed; the border consists merely of two straight lines; the region is mostly barren deserts and mountains; and the line forms the western margin of Nevada, the most sparsely inhabited of all the states.

Actually, the boundary which appeared so clear and definite on paper had to be located and marked on the unknown physical features of a region of difficult accessibility, a process made slow and costly by the very sparsity of population. Furthermore, when rapid changes in economic and political geography occurred during the early period of unknown boundaries, conflicting claims of territory and jurisdiction naturally arose.

The northern part of the border zone is associated with the Sierra Nevada. The steep eastern slope of these rugged fault block mountains extends generally north and south, penetrated by deep canyons with alluvial fans at their mouths. In places there are foothills flanking the eastern face of the Sierra. These mountains form the western edge of the Great Basin, an intermontane plateau with semi-arid climate and sagebrush vegetation. Only certain favored spots, such as the alluvial fans and the valleys of the foothills which flank the Sierra, are useful as agricultural land.

South of Lake Tahoe the border extends toward the southeast, thus leaving the Sierra and crossing alternately the desert basins and north-south ranges of mountains which characterize the Great Basin country. The climate becomes drier and hotter, with the plateau vegetation changing from sagebrush to creosote bush and cactus. The tops of the basin ranges, like the crests of the Sierra, are forested.

The early history of this remote region featured a "floating" western boundary of Nevada. This gave rise to many difficulties, including a small border war in the north and a frontier town in the south which operated as the county seat for two different counties (one in California and one in Nevada) at the same time. Then the actual demarcation of the southern part of the line—from Lake Tahoe southeasterly to the Colorado River—presented a unique and perplexing puzzle. This boundary segment started at a point in Lake Tahoe which was far from shore and ran obliquely over basin and range country to the center of a stream that shifted its course several times during the period of survey. Boundary disputes and demarcation problems were major affairs of the region for several decades.

The California constitutional convention of 1849 was the scene of lively debates

on the proper location for the eastern border of the new state. The lines proposed were as far east as Colorado and as far west as the Sierra Nevada. The advocates of a large territory maintained, among other things, that all of the Great Basin and part of the Rocky Mountains were "California" as the Spanish and Mexicans had used the term and that a reduction of the area would leave territory outside the jurisdiction of any state or territorial government. Also, the inclusion of the large area in free California would settle the slavery question for the United States.

Those favoring a smaller state argued that an area extending across several mountain ranges for 1,200 miles into the interior from the Pacific Coast was entirely too large to be represented in a single state legislature; that Congress would probably refuse admission to such a large state and might divide it into northern and southern parts; that a smaller state could include a large strip of the Pacific Coast, the western shore of the Colorado River and all other features of real value while excluding the worthless desert areas east of the Sierra; and that the Mormons near Great Salt Lake would surely object to being governed by distant people with different religions and civil views.¹

The latter series of arguments finally prevailed and California was launched as a state with the present boundaries. Next to California lay the unoccupied and largely unexplored deserts of the Great Basin. The heart of Mormon Utah, of course, was Salt Lake City, much farther to the east.

THE FORMATION OF NEVADA TERRITORY

On the same day (September 9, 1850) that California was admitted as a state, the Territory of Utah was formed to include roughly the areas that are now Nevada and Utah (Fig. 1). The new territory was "bounded on the west by the State of California . . ." and it was provided that Utah could be divided "into two or more Territories, in such a manner and at such times as Congress shall deem convenient and proper. . . ."²

The apparently unoccupied land near the California border soon became an irritating area for Utah and led to demands for division of the territory.

Probably the first settler in what is now Nevada arrived in April of 1849,³ and by 1853 there were a number of small farms and stations which furnished food and supplies to emigrants on their way to California. These settlements of Carson

¹ More detailed discussions of the eastern boundary question are found in J. Ross Browne, *Report of the Debates in the Convention of California on the Formation of the State Constitution in September and October, 1849*, Washington, 1850. Cardinal Goodwin, "The Question of the Eastern Boundary of California in the Convention of 1849," *Southwestern Historical Quarterly*, XVI: 227-258; and Mary Alice Dana, *California Boundaries, past and present, their relation to geographic conditions*, unpublished M.A. thesis, University of California, Berkeley, 1919.

² *The Congressional Globe*, 31st Congress, 1st Session, 1850, p. 1772; *U. S. Statutes at Large*, IX: 453.

³ H. S. Beatie, "First in Nevada," *Nevada Historical Society Papers*, I (1917): 168-171.

Valley (Fig. 1) had close contacts with California which lay just across an unmarked boundary.⁴

From the standpoint of political geography the situation of these settlements in the extreme western part of the Territory was most unfortunate. Nearby California courts and officials had no jurisdiction; the government of Utah Territory was centered in Salt Lake City, hundreds of miles to the east, across some of the most discouraging deserts and mountains of the country.

The state surveyor of California was requested to determine the location of the boundary near Carson Valley to settle definitely whether the area was in the state. Although a complete survey was not made, the investigations in 1852 indicated that this valley at least, lay beyond the borders of California.⁵

In February 1853, the people of the valley petitioned the California legislature for annexation to the state for judicial purposes, on the grounds that they were neglected by the Utah government.⁶

It was argued that the boundary would be difficult to survey because of the mountains, and that some of the valleys on the eastern slope of the Sierra would be divided by the line. Furthermore, the people were at the mercy of the lawless bands of criminals who had escaped into the valleys from California. The country was contiguous to California, dependent upon it for supplies, and inaccessible from it only for a short winter period. On the other hand, there was a much longer time when Carson Valley was separated from Salt Lake City by the snow of the deserts. Extending the eastern boundary of California into the desert would solve these problems. A line from the intersection of 42° N. Lat. and 120° W. Long. to the point where the Colorado River is intersected by 35° N. Lat. was advocated (Fig. 1).

None of the requests were granted, however. Carson Valley had already organized its own local government,⁷ and was successful in obtaining a county government from the Utah Territorial Legislature in January, 1854.⁸ But the great distance between Carson County and the capitol of Utah made the arrangement an awkward one. The Carson settlers continued their attempts to join California.⁹

⁴ John Reese, *Mormon Station*, manuscript in Bancroft Library, University of California, Berkeley, and printed in *Nevada Historical Society Papers*, I (1917): 186-190; Sam P. Davis (Ed.), *The History of Nevada*, 2 vols. (Los Angeles, 1913). Vol. 1, pp. 228-229. Some of the settlers at this time were actually on the western side of the line, in California, but thought they were in Utah Territory. Cf. Myron Angel (Ed.), *History of Nevada* (Oakland, 1881). pp. 11-19; and Hubert H. Bancroft, *History of Nevada, Colorado, and Wyoming* (San Francisco, 1890). pp. 69-72.

⁵ "Annual Report of the Surveyor General, December 15, 1852," p. 14, App. Doc. No. 3 in *California Senate Journal*, 4th Session, 1853. This report also contains correspondence concerning the 1851 survey of the southern end of the border.

⁶ *California Senate Journal*, 4th Session, 1853, pp. 90, 130-131, and App. Doc. 46; and Bancroft, *op. cit.*, pp. 74-75.

⁷ Davis, *op. cit.*, Vol. 1, p. 190, and Bancroft, *op. cit.*, pp. 69-70.

⁸ *Utah Acts*, 1855, p. 261; Angel, *op. cit.*, pp. 37-39; and Davis, *op. cit.*, Vol. 1, pp. 190-191.

⁹ *California Assembly Journal*, 7th Session, p. 141; Bancroft, *op. cit.* p. 78.

WESTERN UNITED STATES

(Boundaries of 1850)



FIG. 1. Western United States, showing actual boundaries of 1850 and proposed changes for the California-Nevada border in 1853 and 1856.

In 1856 California vainly petitioned Congress to extend her eastern border to the 118th Meridian so as to include the settlements of western Utah¹⁰ (Fig. 1). The arguments, as before, were that the boundary divided certain valleys of the eastern Sierra slope between two governments and separated Carson Valley from nearby California. Congress, on the other hand, believed that California was already too large.

While California was trying to extend her border eastward, the political situation in Carson Valley became still more difficult. Additional Mormon settlers arrived during the spring and summer of 1856, and obtained temporary control of the area from the Gentile, or non-Mormon, population.¹¹

The next year (1857) Carson County lost its self-government and was attached to Salt Lake City. Repeated appeals to California caused that state to memorialize Congress to make Carson Valley into a new and separate Territory.¹² The Congressional Committee on Territories suggested a "Territory of Nevada" to extend from the California border eastward to about the 114th Meridian, but the bill failed to pass.¹³ Western Utah (which included Carson Valley) also proposed a new territorial government for the area, but suggested that the western border be extended to the crest of the Sierra Nevada, thus including the disputed valleys of the border zone.¹⁴

Many of the arguments advanced for the separation of the Carson Valley region from the Territory of Utah were derived from the geography of the period. It was maintained that the area was too far from the seat of authority in Salt Lake City. This great distance prevented the Utah authorities from properly administering the wants and desires of the people of the Carson region; police protection and the enforcement of civil law were inadequate. The Carson region was described as a "good geographic unit" since it was more closely linked together within itself than allied to Utah Territory. It also had different economic interests than the parent country—it was developing into a mining area while Utah was primarily agricultural. And the religious clash between Mormon Utah and the Gentile Carson region made harmony difficult, if not impossible.¹⁵

¹⁰ *Senate Miscellaneous Document No. 48*, 34th Congress, 1st Session; *House Committee Reports*, 34th Congress, 1st Session, No. 116; and *California Assembly Journal*, 1855, 7th Session, pp. 387-388.

¹¹ William Jennings, *Carson Valley*, manuscript in Bancroft Library, University of California, Berkeley, p. 3. Some of the Mormons were later recalled to Salt Lake City, and new settlers were predominately non-Mormon, so that Nevada has been traditionally non-Mormon.

¹² *House Executive Document No. 96*, 35th Congress, 1st Session.

¹³ *House Journal*, 35th Congress, 1st Session, p. 789; *Congressional Globe*, 35th Congress, 1st Session, p. 2122.

¹⁴ Angel, *op. cit.*, pp. 68-73. The other proposed boundaries were 35° N. Lat. on the south; the Colorado and Virgin Rivers on the southeast to the Muddy River junction and then north to Oregon; and the Oregon border on the north.

¹⁵ Cf. Angel, *op. cit.*, pp. 43-45 and 61-75; Beulah Hershisser, "The Adjustment of the Boundaries of Nevada," *First Biennial Report, Nevada Historical Society*, Carson City, 1909, pp. 126-127; and Edwin Truesdell Force, *The Counties of Nevada, Organization and Significance, 1849-1873*, unpublished M.A. thesis, University of California, Berkeley, 1932, pp. 48-69.

While the movement for territorial government was gaining strength, California continued to urge Congress to provide for a survey of the troublesome eastern border.¹⁶ Some survey work was done, as will be explained later, but the total results were so inadequate that a "floating" western boundary soon became a major feature of the new territory.

The Territory of Nevada, consisting mainly of territory taken from Utah, was organized by the act of March 2, 1861, with boundaries as follows:

"beginning at the point of intersection of the forty-second degree of north latitude with the thirty-ninth degree west from Washington; thence running south on the line of said thirty-ninth degree of west longitude, until it intersects the northern boundary line of the Territory of New Mexico; thence due west to the dividing ridge separating the waters of Carson Valley from those that flow into the Pacific; thence on said dividing ridge northwardly to the forty-first degree of north latitude; thence due north to the southern boundary of the State of Oregon; thence due east to the place of beginning."¹⁷

This, of course, placed the western boundary of Nevada essentially on the crest of the Sierra Nevada and transferred the land along the eastern slope from California to Nevada (Figs. 1 and 2). It was, therefore,

"Provided that so much of the territory within the present limits of the State of California shall not be included within this Territory until the State of California shall assent to the same."¹⁸

Some of the people of the border zone preferred inclusion in Nevada and petitioned the 1861 session of the California Legislature to approve the new boundary. A bill to that end, however, received an adverse report in committee.¹⁹ The new Territory therefore inherited a serious border problem: the unmarked, and largely unsurveyed eastern boundary of California had been further complicated by the indefinite status of the proposed Nevada boundary which lay farther west. Between the two unmarked lines lay territory—claimed by both governments (Fig. 2).

OVERLAPPING COUNTIES IN THE NORTH

The first session of the Nevada Territorial Legislature planned the strategy for securing California's approval of the Sierra boundary. The Nevada governor believed that an approach in the proper spirit would succeed. He emphasized that the Sierra formed a "natural frontier," that the lands on both sides had mutual interests, and that California could spare the small portion of her "vast domain."²⁰ While Nevada debated, planned, and appointed commissioners to present its argument at the next meeting of the California Legislature, the San Francisco press campaigned against the loss of territory.²¹ A resolution and a memorial²² prepared the

¹⁶ *California Statutes*, 1858, pp. 356-357.

¹⁷ *U. S. Statutes at Large*, Vol. 12, pp. 209-210.

¹⁸ *Ibid.*

¹⁹ *California Senate Journal*, 1861, pp. 535, 559, 862.

²⁰ *Nevada Council Journal*, 1861, pp. 97, 113, 115; *San Francisco Bulletin*, October 31, 1861.

²¹ *Laws of Nevada Territory*, 1861, Res. No. 2, p. 513; *Nevada Council Journal*, 1861, pp. 128, 146, 168, 183, 195, 226, 258, 261, 274; *San Francisco Bulletin*, November 1 and 14, 1861, March 21, 1862; *Daily Alta California*, March 22 and 25, 1862.

²² *Laws of Nevada Territory*, 1862, Concur. Res. No. VI, p. 195; *California Senate Journal*, 1862, p. 387.

way for Nevada's plea before the California Legislature. There was some sentiment in the California Legislature for Nevada's cause, partly because of the previous petitions from people of the border zone. On the other hand, there were farm lands

HISTORICAL DIAGRAM of NEVADA

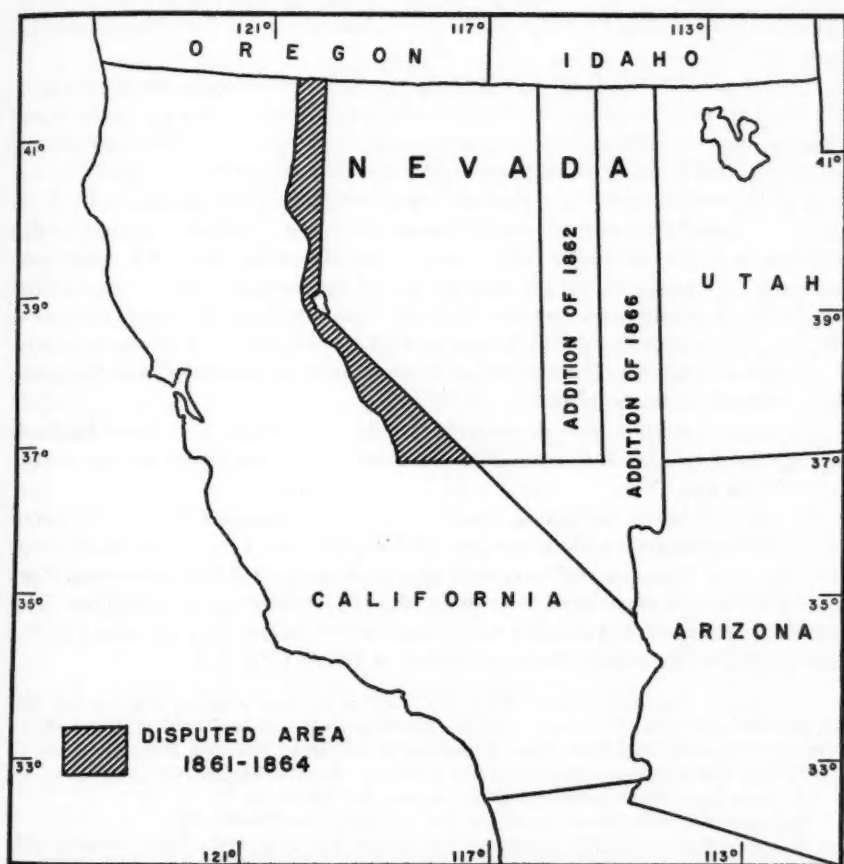


FIG. 2. Historical Diagram of Nevada. The "Sierra Crest" boundary is shown approximately as it was interpreted by the *De Groot Map of Nevada Territory, 1861*, in Bancroft Library, University of California.

and new mines that meant taxable wealth, and a projected railroad across the mountains would be easier to build if California controlled the land.²³

Governor Nye of Nevada led the delegation from his state. His appeal before the California Assembly on March 21, 1862, was a masterpiece of both geopolitical argument and rhetorical eloquence. He stressed the logic of "natural boundaries," and compared "California's glistening seacoast" with "Nevada's frowning desert from which was extracted the wealth that flowed into the lap of a prosperous San Francisco!" He said that "murderers escape because of conflicting jurisdiction and threaten the lives of good and loyal citizens in both California and Nevada. . . ." Also, Nevada stood "ready to aid her neighbor state in promoting the interests of a triumphant Pacific Coast! Why question her claim to a mere 5 to 30-mile strip of waste land?"²⁴

The so-called "waste land" was far from worthless according to the standards of the new Territory. Besides the taxable farm land (a scarce item in Nevada) there were the mines and the yellow pine forests of the Sierra slopes. The small amount of useful timber had always been one of the difficulties of mining in Nevada.²⁵

The California Legislature claimed that it would be unconstitutional for it to give the disputed strip of territory to Nevada: the state boundaries, defined by the constitution, could be changed only by the process of amendment, which would take three years. Nye argued in vain that the federal constitution took precedence over the California constitution, and that since the new boundary of Nevada's Organic Act had already been approved by Congress and Nevada, it would only be necessary for California to agree. The matter was finally postponed indefinitely and Governor Nye returned unsuccessful to Nevada.²⁶

Nevada also tried to have the western boundary line of her organic act legalized through further action in Congress, but the California interests were strong enough to block the move.²⁷

On the eastern side of Nevada, however, where there were a few new settlements and potential mineral wealth, it was possible to enlarge the Territory at the expense of Utah. The Mormons and Nevadans were continually in disagreement, and Congress welcomed an opportunity to reduce the area controlled by the Mormons. The eastern boundary of Nevada was moved one degree (more than 50 miles) to the east in 1862, with a second similar extension in 1866²⁸ (Fig. 2).

²³ *California Assembly Journal*, 1862, p. 599; *California Senate Journal*, 1862, pp. 413, 485, 517, 525, 535; and Ella Ward Ryan, *Federal Relations with Nevada Territory, March, 1861-October, 1864*, unpublished M.A. thesis, University of California, Berkeley, 1928.

²⁴ *Daily Alta California*, March 22, 1862; *California Statutes*, 1862, p. 612.

²⁵ *House Executive Document 26*, 37th Congress, 3rd Session, p. 12.

²⁶ *Nevada Assembly Journal, Governor Nye's Message*, 2nd Session, 1862.

²⁷ *Congressional Globe*, 37th Congress, 2nd Session, Part 2, p. 1847; *House Journal*, 37th Congress, 2nd Session, p. 616.

²⁸ On the 1862 extension see *U. S. Statutes at Large*, Vol. 12, p. 575, and *Congressional Globe*, 37th Congress, 2nd Session, App. 408. On the 1866 change cf. *U. S. Statutes at Large*, Vol. 14, p. 43.

Meanwhile, the stage was being set for an intercounty war in the California-Nevada border zone. Roop County, in northwestern Nevada, was organized in 1862 to extend to the western boundary of the Territory, presumably to the crest of the Sierra.²⁹ The new county therefore overlapped the edge of Plumas County, California, which bordered on the unmarked eastern boundary of California. The Nevada County was mostly useless desert, but the disputed land of the western part contained the town of Susanville and several agricultural valleys. The county seat was fixed in Susanville and a special term of the First District Court was authorized for January, 1863. The Nevada Legislature also validated all rights acquired in the border zone under California law, and authorized the transfer of pending cases to Nevada courts.³⁰

The territorial dispute caused confusion in many ways. Some residents were adept at avoiding taxes by switching allegiance to Nevada or California when tax payments became due in the other. Some valleys did not know where to apply for school money or for protection from Indians. Many California residents preferred and demanded inclusion in Roop County, Nevada, because the county seat of Susanville was readily accessible and the territorial capital of Carson City was only a hundred miles away; their trade and social relations were with Nevada. On the other hand, the county seat of Plumas County, California, was at Quincy, on the western side of the rugged Sierra, over trails that could be negotiated during the winter only on snowshoe; and the distance to the state capital at Sacramento, over the more accessible routes, was several hundred miles. The indefinite political geography even resulted in a governor's appointment of a Commissioner of Deeds for California who was to reside in "Susanville, N. T.," thus inferring that the town was in Nevada.³¹

The Roop-Plumas County battle occurred after the first session of the Nevada Court was held at Susanville in January, 1863. There are conflicting accounts on the details,³² but the serious trouble arose when the Roop County Probate Judge issued an injunction against a Plumas Justice of the Peace restraining him from holding court in the disputed part of Roop County. The Justice of the Peace ignored the Nevada order, so he was fined \$100.00 for contempt of court, imprisoned, and then released on parole. A Plumas County judge then issued an injunction against both the judge and the sheriff of the Nevada County, which was promptly countered by another Roop County injunction against the California Sheriff.

Meanwhile, the Plumas County Sheriff arrested the Roop County Sheriff, but the latter escaped (or was released, according to some accounts) and gathered an armed band in Susanville. The Plumas Sheriff likewise formed a posse and in the

²⁹ *Laws of Nevada Territory*, 1862, p. 6.

³⁰ *Ibid.*, pp. 37-39.

³¹ *San Francisco Bulletin*, February 25, 1863.

³² This account is condensed from the *Territorial Enterprise* of February 17, as reprinted in the *San Francisco Bulletin* of February 23, 1863; *Plumas Union* of February 18 and the *Territorial Enterprise* of March 3, as reprinted in the *San Francisco Bulletin*, March 5, 1863; Angel, *op. cit.*, p. 101, and E. F. Mack, *History of Nevada* (Glendale, California, 1936). pp. 399-403.

ensuing battle several persons were wounded. A peace meeting of private citizens was able to stop the feud and convince both sides that rival claims of jurisdiction should await the results of a report of the situation to the governors of both Nevada and California. The final result was that California kept all her territory (by refusing to approve the Sierra boundary), but agreed to cooperate with Nevada in a joint boundary survey.³³

It appears that this border war in the north was caused by the haste of Nevada in organizing Roop County and claiming the territory up to the Sierra crest before California had approved the boundary. The indefinite knowledge of the eastern margin of California—the official boundary—was merely a confusing and complicating item in the situation.

BORDER PROBLEMS IN THE SOUTH

At the same time, however, the haste of California in the south led to encroachment upon Nevada Territory in a region where the unknown location of the boundary was a critical feature.

California established Mono County on March 24, 1861.³⁴ The county seat was located on the eastern border, at Aurora. This town, in a new silver mining district, was also claimed by Nevada. Before the new Territory could take any action, California had organized the county and elected the officers. When the governor of Nevada first visited Aurora in July, 1861, he found a unique, puzzling, and irritating situation—a California county seat was located in Nevada.³⁵

Since the governor was certain that Aurora was in Nevada, he included it in Esmeralda County. Aurora became the new county seat, thus serving two counties—one in California and one in Nevada—at the same time. The surveys of 1862 established part of the boundary, but did not settle the problem of Aurora, because the incomplete survey work was subject to different interpretations.³⁶

The confusing situation continued through the Territorial elections of September 3, 1862. The Mono County officials were still serving their unexpired terms of office, but Esmeralda County had only its delegates to the Territorial Legislature. No election of officers for the Nevada County was held that year. California, with an operating county government, was in control.

With the recent northern border war as a deterrent, the Nevada governor refused to do anything to intensify the dispute in Aurora, in spite of prodding from the Legislative Assembly.³⁷

The boundary survey of 1863 and the Territorial elections approached Aurora at the same time. The Nevada governor had been reasonably certain from the first that Aurora was within Nevada. As soon as the early part of the survey work

³³ *California Senate and Assembly Journal*, 1863, App. No. 34, pp. 3-12; *California Statutes*, 1863, pp. 617-619.

³⁴ *California Statutes*, 1861, pp. 235-238.

³⁵ *San Francisco Bulletin*, Nov. 14, 1862.

³⁶ Surveys will be considered later in more detail.

³⁷ *Laws of Nevada Territory*, 1862, Res. No. 1, p. 193.

tended to confirm this opinion, he sent a judge (July, 1863) to Aurora to preside over the Nevada Second District Court. The California court continued to function in the same town, and much more effectively, since Aurora had been incorporated under California laws and Mono County had all the records. The election date of September 2, 1863, came before the survey established the boundary in the vicinity. Therefore a most unusual voting procedure was agreed upon to provide officials for either result: the citizens were permitted to vote for both Esmeralda and Mono County officials. Less than two weeks later the survey established that Aurora was within Nevada by four miles. The Mono officials moved their records to Bridgeport, and Esmeralda County was left in control.³⁸

The Nevada policy of waiting peacefully until the boundary survey confirmed the claim to Aurora prevented violence. In the end, the premature action of California in setting up county offices in Aurora—like the equally hasty action of Nevada in Roop County in the north—provided no lasting advantages. The encroachments of California upon silver mines to the southeast and Nevada upon farm lands to the west were of short duration. Both arose because of the indefinite nature of the floating boundary, and disappeared when the position of the border was established.

DEMARCATON OF THE 120TH MERIDIAN BOUNDARY

Although the general locations were now fixed, neither the northern meridian segment nor the southern oblique portion of the California-Nevada Boundary were accurately surveyed until much later. The meridian boundary line was first to be completed (in 1860-63, 1868, and 1872).

The 1860-61 survey of the 120th meridian boundary by the U. S. Government established a point for the southern terminus at Lake Tahoe.³⁹ The appropriated funds, although amounting to \$37,000, were exhausted before much was accomplished on the actual surveying of the border.⁴⁰ Later surveys by Nevada in the same year established the boundary from Lake Tahoe (referred to as "Lake Bigler" at that time) northward to Honey Lake.⁴¹ In 1863, after the Roop County-Plumas County War, California and Nevada cooperated in completing the survey of the Meridian line and both legislatures later approved the boundary.⁴² These surveys from 1860 to 1863 all followed the constitutional eastern margin of California rather than the Sierra crest as claimed by Nevada. And when Nevada became a state in 1864⁴³ its western boundary was described as following the eastern border

³⁸ Angel, *op. cit.*, pp. 102, 401-403; *Laws of Nevada Territory*, 1864, pp. 93-94, 110-114; *Statutes of California*, 1865, p. 144; *Aurora Times*, quoted in *San Francisco Bulletin*, September 25, 1863; *San Francisco Bulletin*, September 19 and 26, 1863.

³⁹ *U. S. Statutes at Large*, Vol. XII, p. 22.

⁴⁰ *Senate Executive Document*, No. 1, 37th Congress, 2nd Session, pp. 490-501; *Daily Alta California*, January 13, 1862.

⁴¹ *Statutes of Nevada*, 1861, p. 132.

⁴² *California Statutes*, 1864, pp. 506-507; *Statutes of Nevada*, 1864-5, pp. 133-134.

⁴³ *U. S. Statutes at Large*, Vol. 13, p. 30.

of California, thus ending, for practical purposes, the question of a border along the Sierra Nevada.⁴⁴

Although the delimitation (agreement on the place and description of the line) was now complete, the final demarcation (locating and marking the line on the ground) was not made until several years later. In 1868 a point was located for 42° North Latitude and 120° West Longitude, the place where the northern end of the meridian boundary was supposed to meet the southern margin of Oregon. The line surveyed between 1860 and 1863, it was discovered, was not far enough west to coincide with the 120th Meridian. New monuments were therefore placed farther west, giving Nevada an additional small strip of desert land.⁴⁵

New boundary markers were established for the third and final time as a result of the survey of 1872. At this time the monument at the north end of the line was moved 3 miles east of the 1868 location, and markers (mostly wooden posts surrounded by stones) were placed at important points along the boundary. This is the line which still governs, although it was discovered in 1899 that the southern end of the boundary is considerably west of the 120th Meridian.⁴⁶ The actual longitude of the boundary varies from 120° 00' 04.05" W. to 120° 00' 55.44" W.⁴⁷

A meridian line was difficult to locate and survey in the early days. And by 1899 the line, although inexact, had been accepted and used by both states and the federal government. Once a line is actually marked on the ground and accepted by the parties concerned it is, of course, allowed to remain although minor miscalculations may have been made in the surveys.

DEMARCATON OF THE OBLIQUE BOUNDARY

The oblique line separating California from Nevada has many unique features; the great length (405.146 miles), the barren nature of the landscape involved, the timely settlement of the Aurora dispute, and the difficulties involved in the survey.

The terminals of the boundary, as well as the line itself, provided some perplexing problems for the surveyors. The northern terminus is the intersection of the 120th Meridian and the 39th parallel of latitude, which falls in Lake Tahoe, over 2 miles from shore. The southern terminus is the intersection of the 35th parallel with the middle of the Colorado River. Thus, both ends of the line are located in water bodies rather than on dry ground. Furthermore, several kinds of "straight lines" can be run on the earth's surface to connect the two terminals. Since succeed-

⁴⁴ Nevada made only one feeble attempt, in 1871, to re-open the matter of a Sierra boundary. Cf. *Laws of Nevada*, 1871, pp. 185-188.

⁴⁵ Edward M. Douglas, *Boundaries, Areas, Geographic Centers and Altitudes of the United States and the Several States*, U. S. Geological Survey, Bulletin 817 (Washington, 1930), p. 236; C. H. Sinclair, "The Oblique Boundary Line Between California and Nevada," Appendix 3 to *U. S. Coast and Geodetic Survey Annual Report for 1900* (Washington, 1901), pp. 274-276.

⁴⁶ Douglas, *loc. cit.*

⁴⁷ U. S. Coast and Geodetic Survey, *Special Publication 19*, 1914, pp. 113-114.

ing surveyors often used methods and data differing from earlier ones, the results also varied.⁴⁸

In 1852, a general sketch of the Colorado River was made by a government engineer. Since information on the then remote and largely unexplored country was exceedingly scarce, the map was useful⁴⁹ in determining the longitude of the southern terminus a few years later—in 1855.

While the Colorado River was being investigated at the southern end of the oblique border, the Surveyor-General of California was making his survey of 1852 on the limits of California at the northern end of the line.⁵⁰ But the work of accurately locating the terminals and marking the line between was not finished until almost half a century later—in 1899.

In 1855 a surveyor for California investigated the border in Carson Valley. He also made a location of the northern terminus at Lake Tahoe and computed the angle of the boundary to the southern end as previously sketched.⁵¹ Thus it seemed at this early date that it would be comparatively simple to complete the survey by running a line between the two points and setting up markers.

However, both political support for the survey and the necessary funds were hard to obtain. The Territory of Utah was more interested in maintaining its hold on the remote western border zone than in contributing to a survey. California made a number of futile appeals to Congress and then finally, in 1860, provided for its own survey of the line.⁵² Soon afterwards, Congress also authorized a survey.⁵³

The unsettled nature of the boundary had already created confusion as to which government had the authority to collect revenue and the responsibility of enforcing criminal laws.⁵⁴ But probably the major factor influencing California to take definite action in 1860 was the discovery of silver at Esmeralda, in the border zone, with the possibility that the area might lie in California.⁵⁵

The surveys of 1860-61 covered part of the meridian boundary, as described earlier, and also determined new locations for both ends of the oblique line. Once again it appeared that the terminals had been accurately located so that it remained

⁴⁸ The history and operational details of the survey are summarized in C. H. Sinclair's 229-page Appendix 3 to the *U. S. Coast and Geodetic Survey Annual Report for 1900*.

⁴⁹ The 1852 sketch and report were published in *Executive Document No. 59*, 32nd Congress, 2nd Session.

⁵⁰ *California Senate Journal*, 4th Session, 1853, App. Doc. No. 3, pp. 3-14.

⁵¹ C. H. Sinclair, *op. cit.*, pp. 264-265.

⁵² *California Statutes*, 1857, p. 377; 1858, pp. 356-357; 1859, pp. 313, 385; 1860, pp. 184-185, 409; 1861, p. 73. *California Assembly Journal*, 1858, pp. 56-57; 1860, p. 250. *House Journal*, 35th Congress, 1st Session, pp. 977-978 (Serial 940). *Senate Journal*, 35th Congress, 1st Session, pp. 555, 590 (Serial 917).

⁵³ *U. S. Statutes at Large*, Vol. 12, pp. 22, 110; *Congressional Globe*, 36th Congress, 1st Session, pp. 110, 475, 895, 1620, 2302-3, 2408.

⁵⁴ *California Assembly Journal*, 1858, pp. 137-140; 1860, p. 250.

⁵⁵ *California Senate Journal*, 1860, pp. 371, 434; *Senate Misc. Doc. 18*, 36th Congress, 1st Session (Serial 1038).

only to make additional computations and run the line. But the work accomplished was small when compared to the cost involved.⁵⁶

Soon after the organization of Nevada Territory in 1861 the new government appointed a surveyor-general who surveyed parts of Carson Valley and other areas where settlers were located near the border. Nevada also declared that some of the earlier surveys which had been made by Utah were invalid. Opposition to the surveyors was therefore common in areas where people held claims based upon previous Utah surveys.⁵⁷

In 1862 work started on a survey from the northern terminus toward the southeast.⁵⁸ But since the line had not been completed to the Colorado River and then adjusted for the errors that might logically be expected, the line was interpreted by some to be a preliminary rather than a final boundary. Trouble continued over mining claims and over jurisdiction for taxation and law enforcement.⁵⁹ Even the Aurora question was not definitely settled until the next year.⁶⁰

The oblique boundary was run southeasterly from Lake Tahoe in 1863, passing Aurora (and giving it to Nevada) just after the September elections. The surveyors were forced soon afterward to retreat from a hostile encampment of several hundred Indians. The added difficulties of a severe snow storm and shortage of supplies brought the survey to a halt.⁶¹ Although the surveyed 102-mile portion of the border could not be accepted as final and correct until the line reached the Colorado River, it at least settled the Aurora question and was accepted by both California and Nevada.⁶²

The serious border disputes between California and Nevada had therefore been resolved before Nevada was admitted to statehood in 1864. The enabling act⁶³ merely confirmed California's eastern border as the western margin of the new state; the possibility of a Sierra boundary had actually ended with California's refusal to cede the lands east of the Sierra.

If the Sierra border had been approved by California, the immediate result would have been to lose certain timbered areas and farm lands. A more important

⁵⁶ *Senate Executive Document No. 1*, 37th Congress, 2nd Session, pp. 490-501 (Serial 1117). The location of the southern terminal of the oblique line was furthered by an additional sketch of the Colorado River which had been made in 1858. A report of the expedition is found in *House Executive Document No. 90*, 36th Congress, 1st Session. For additional information on the 1860-61 terminal locations cf. *Annual Report, U. S. Secretary of the Interior*, 1865, pp. 13-15, and C. H. Sinclair, *op. cit.*, pp. 266-267.

⁵⁷ *Senate Executive Document No. 1*, 37th Congress, 2nd Session, pp. 466-467 (Serial 1117).

⁵⁸ *Statutes of Nevada*, 1861, p. 269; 1862, p. 114.

⁵⁹ Bancroft, *op. cit.*, p. 154.

⁶⁰ *San Francisco Bulletin*, November 14, 1862.

⁶¹ "Report of the Surveyor-General upon the Eastern Boundary Survey," Report 3 in *Appendix to Journals of Senate and Assembly*, Fifteenth Session of the Legislature, State of California, 1864.

⁶² *California Senate and Assembly Journal*, 15th Session, p. 763; *Statutes of Nevada*, 1864-5, pp. 133-4, 347.

⁶³ *U. S. Statutes at Large*, Vol. 13, p. 30.

effect would have appeared later. Part of Owens Valley, from which Los Angeles obtains much of its water supply, would have gone to Nevada and the problem of water rights would have been more complicated.

Nevada had the boundary extended in 1865 for about 73 miles beyond the point where the 1863 survey ended. But hundreds of miles of the border zone (mostly uninhabited) still remained unsurveyed.⁶⁴

Then, in 1872-73, the complete California-Nevada boundary, from Oregon to the Colorado River, was resurveyed by A. W. Von Schmidt under contract of the General Land Office. After marking the northern part of the frontier, the surveyor determined a new location for the intersection of 39° N. and 120° W. at Lake Tahoe and struck an azimuth to the point on the Colorado River which had been located in 1852, 1855, and 1861. The boundary was marked by granite monuments at the southeastern shore of Lake Tahoe and at places where important roads crossed the border. Wooden mileposts were set up along the way, and finally, when the survey reached the Colorado River, a cast iron monument was erected.⁶⁵

The southern end of the line missed the junction of 35° with the Colorado River (as the point had been located in 1861) by several hundred yards. Also, the river in 1873 was no longer in its previous position; it had swung westward for a distance of more than a mile (Fig. 3). The question now arose, should the boundary be corrected to meet the present junction of 35° with the center of the river—or the junction as it had been computed in 1861? The flood plain over which the river meandered at will was more than two miles in width, and the early sketches, together with the meander scars of former courses clearly indicated the earlier positions of the stream.

The surveyor wrote the Commissioner of the Government Land Office in Washington, D. C., for instructions. The reply indicated that the 1861 computations had never been received and approved in Washington; therefore the junction of 35° with the center of the present channel should be used. The surveyor accordingly moved the southern terminus about 1½ miles to the southwest to correct for both the shifting of the river and his smaller error in surveying (Fig. 3). The correction was not distributed proportionately all the way back to Lake Tahoe. Starting at the Colorado River the line was adjusted for 130 miles, about 1/3 the length of the oblique boundary, leaving a border with two segments meeting at an angle⁶⁶ (Fig. 4).

By 1887, new data was available from the U. S. Coast and Geodetic Survey which showed that the oblique border should be corrected. The State of California authorized surveys⁶⁷ which found new locations in 1889 and 1890 for both the Lake Tahoe and Colorado River terminals, differing by several hundred feet from the

⁶⁴ C. H. Sinclair, *op. cit.*, p. 270.

⁶⁵ *Ibid.*, pp. 277-279. The iron monument was later washed from its place by a flood. A local man with the assistance of Indians recovered the monument and placed it on the bank, several hundred yards too far north, where it rests at present (1951).

⁶⁶ *Ibid.*, pp. 280-282.

⁶⁷ *California Senate Journal*, 1887, p. 124.

THE COLORADO RIVER TERMINUS

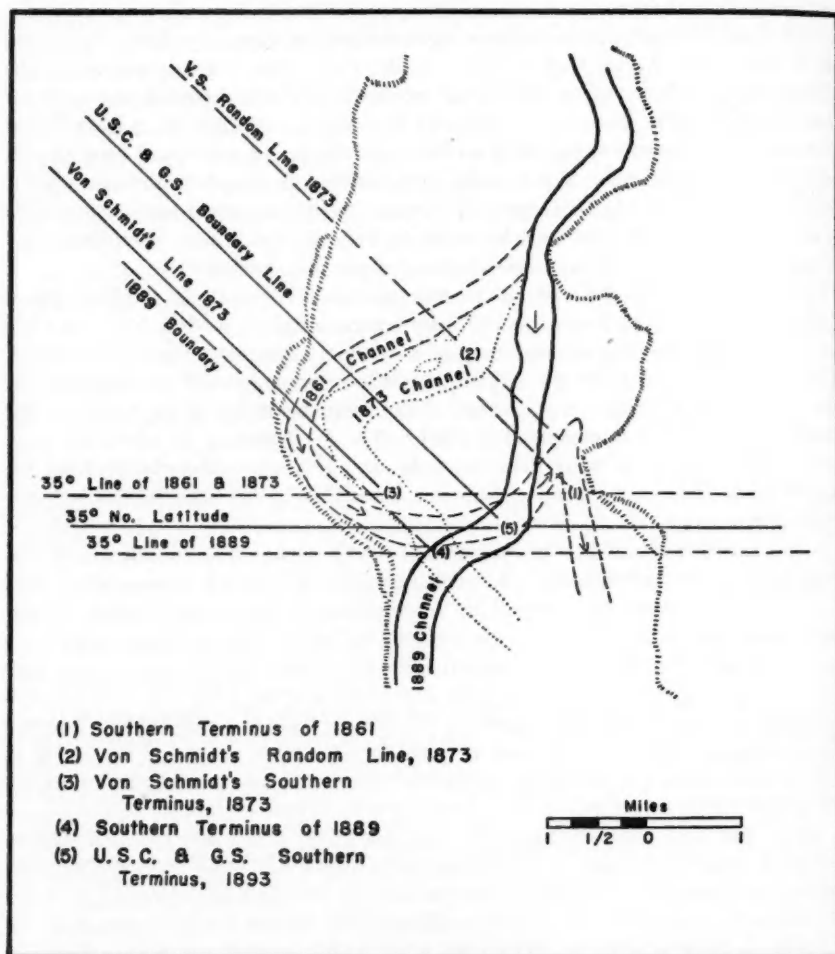


FIG. 3. The Colorado River Terminus. Compiled from sketches in appendix 3 to U.S.C. and G.S. Annual Report for 1900.

previous ones. Only a few miles of the line between the terminals was run before funds were exhausted. The Colorado River had again shifted its course by this

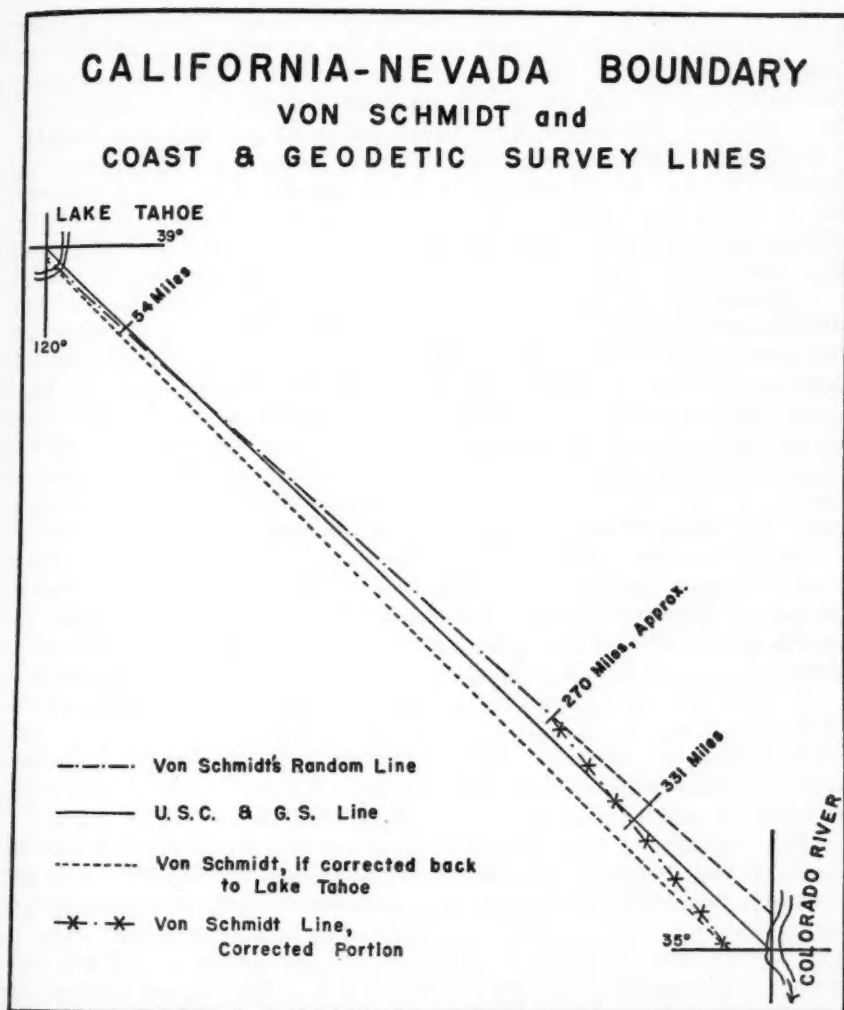


FIG. 4. California-Nevada Boundary, showing relation of Von Schmidt and U.S.C. and G.S. lines. Not to scale; differences between boundary lines are greatly exaggerated.

time, but the former (1873) position of the river was used with a new location for the 35th parallel⁶⁸ (Fig. 3).

The U. S. Coast and Geodetic Survey ran the entire oblique border again from

⁶⁸ Information on the survey of the southern terminus was obtained from C. H. Sinclair, *op. cit.*, pp. 283-288.

1893 to 1899. This is the line which today separates the two states. The first step was to re-locate the Colorado River terminus, but the point finally accepted was along the 35th degree line (which had to be determined for the third and last time), midway between the bluffs or stable banks of the stream—a new, but logical, solution. The banks were found to be 2.75 miles apart along the 35th degree, enclosing a flood plain on which the river commonly shifted its course during high water in summer (Fig. 3). In 1861 the river was on the east side of the plain, and the surveyors of 1893 found an oxbow lake marking the abandoned former channel. In 1873 the river was on the western side and a small lake remained from that channel, too. But in 1893 the river was nearly in the center, midway between the bluffs.⁶⁹

After locating the southern terminus, the surveyors moved to Lake Tahoe and determined that end of the line. During the summer of 1894 the survey of the line was started at Lake Tahoe. Work continued the next summer. When additional funds were obtained, the survey was resumed, in 1898–99, with work being done during the cooler months because of the prohibitive heat of the desert summer near the southern terminus. The boundary came within about 170 yards of striking the post which had been set for the southern end in 1893, six years before. The entire line was corrected back to Lake Tahoe during 1899 and marked with wooden posts and piles of stones. These were later replaced with concrete markers.

The new boundary differed greatly from the previous (1873) line, crossing it twice as shown in Figure 4. As a result of the re-surveying, Nevada gained about 321 square miles while California gained about 65 square miles, resulting in a net gain to Nevada of about 256 square miles. Because the border zone was largely barren desert, the change in territory made little difference in taxable arable land.

In recent years the boundary has been checked, and new monuments mark most of the line. Desert trails, roads, and highways provide access to the well-marked boundary in dozens of places. There is nothing to suggest that the California–Nevada line caused a border war, had a county seat that served two counties, and provided a boundary survey of record length and difficulty.

The history of the line, however, again illustrates the principles that accurate location of state boundaries (as well as international borders) is both difficult and necessary; that indefinite frontiers, under our system of laws, can easily lead to serious disputes; that rivers are zones instead of lines and therefore are often objectionable as reference points for boundaries; and that boundaries arbitrarily prescribed for distant unknown regions have often been perplexing ones for both the inhabitants and the surveyors.

⁶⁹ Instructions from the Superintendent of the Coast and Geodetic Survey explained that a correction for an error in latitude which was made in 1861 brings the terminus of that time to a place where the Colorado River ran nearly west to east on the flood plain. This location agrees with the early sketch made in 1858. These maps of 1858 and 1861 are the only ones available for that early period but they show that the position of the river (and therefore of the terminus) was probably the same in 1860, the date Congress authorized the boundary survey. Therefore, it appeared that all conditions would be met by using a terminus midway between the bluffs and on the parallel of 35° north latitude. *Ibid.*, p. 288.

CHINESE CITIES: ORIGINS AND FUNCTIONS*

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URBAN development in China appears to be almost as old as China itself. This may appear anomalous in view of the fact that modern China is overwhelmingly rural and agrarian in character with at least three quarters of its population engaged in agriculture and dwelling in rural hamlets and villages. The beginnings of town building and urban life in China appear to coincide with the Bronze Age and are associated with the second, or Shang, Dynasty. Sometime during the second millennium B.C. there developed among the bronze-using groups in North China the habit of living in clustered settlements composed of rectangular timbered houses forming quadrangular towns defended by ramparts of tamped earth. The Bronze Age civilization did not immediately replace the earlier Neolithic culture in North China, for there was a long period during which the former was restricted to a small warlike, aristocratic, ruling class occupying a number of small, scattered, autonomous city states which existed like islands in a sea of Neolithic barbarism.¹ These town dwellers were the rulers, fighters, landlords and priests all in one. Shang society thus consisted of two very contrasting groups, one urban and the other rural.

CITIES IN ANCIENT AND MEDIEVAL CHINA

Shang and Chou (1450-247 B.C.)

Most of the Shang cities probably were established in connection with an official residence, and served primarily political and military functions. But although the political-defense function was certainly the dominant one in the earliest Chinese cities, it could scarcely be otherwise than that the processing and trading of goods soon came to have a significant place in the new urban society. Artisans and crafts-

*The present study of Chinese cities, together with that which appeared in the December 1951 issue of the *Annals*, is in the nature of a preface to what was planned to be a more ambitious undertaking involving field work in China. A Fulbright grant, with supplementary funds provided by the Social Science Research Council, would have made possible extensive field studies in China in 1948-49. Civil War, and the eventual establishment of the Communist regime throughout China, made a use of these research subsidies impossible. The present paper has been written from notes accumulated in library investigations intended as background for the anticipated field studies.

This work was supported in part by a grant from the Special Research Fund of the University of Wisconsin.

¹ Carl Whiting Bishop, "The Rise of Civilization in China with Reference to its Geographical Aspects," *Geographical Review*, XXII (1932): 617-631. See also: Herlee Creel, *The Birth of China*. pp. 56-67; and Marcel Granet, *Chinese Civilization*. pp. 175-176.

men built and furnished homes and other buildings, and merchants dealt in goods produced both locally and at a distance, the latter including metals, salt, and sea shells. Craftsmen wove cloth from silk and hemp; carved stone, bone, and ivory; and fashioned pottery and bronze.²

Tradition indicates that not long after 1400 B.C. the Shang ruler built a capital city near modern An-yang in Honan province on the western margins of the North China Plain. Archeological excavations have proven the existence of the Great City Shang. No defensive wall surrounding the city has been discovered, but it certainly existed. In the center was the ruler's palace. Around this nucleus were houses inhabited probably by artisans, for the latter formed an intermediate class dependent upon the ruling group.³ The houses of the Great City Shang closely resembled those of modern urban China. The walls of pounded earth supported no weight, and served only as screens. The roofs themselves were made of light poles covered with rush matting and the whole plastered with mud. Little is known about the arrangement of buildings in that city.⁴

The urban culture which had its beginning under the Shang dynasty was brought to full pattern during the feudal period that followed (Chou Dynasty), especially between the eleventh and sixth centuries B.C. There continued to be a China of the cities and a China of the rural villages with a sharp distinction existing between the urban aristocrats and the peasant serfs. The urban aristocrats were vassals of the overlord who was ruler of the city.⁵ Since taxes were paid by the villagers in the form of grain and other produce, the storage of grain required a community center with defense as a major requirement; in other words, a walled city. This type of organization made for a regional structure of "compartments," each compartment comprising a walled city and enough surrounding agricultural land to form a convenient unit of local production, trade, and administration.⁶ The accumulated grain represented wealth to be sure, but it also indicated military strength, for the food supply made it possible to support garrisons for offensive and defensive warfare. Granaries in the nuclear cities likewise supported the large battalions of conscripted labor necessary for maintaining the States' conservancy works.

As flood control, irrigation projects, and canals became more numerous and complex the walled cities became even more fixed as elements of government and administration. Thus a cellular structure of economy and society became established in which each cell consisted of a walled "city in the country" and its tributary agricultural area. The filling in of China was actually accomplished by a multiplication of these relatively homogeneous units or cells, each unit consisting of a rural

² Carl Whiting Bishop, *Origin of the Far Eastern Civilizations*. Smithsonian Institution War Background Studies, No. 1, 1942. pp. 16, 22-23. See also: Ralph Turner, *The Great Cultural Traditions. Vol. I, Ancient Cities*. pp. 407-412; Owen Lattimore, *Inner Asian Frontiers*. pp. 39-41, 270-271; Creel, *op cit.*, pp. 95-125.

³ Wolfram Eberhard, *A History of China*. p. 16.

⁴ Creel, *op. cit.*, pp. 57-71.

⁵ Granet, *op. cit.*, pp. 175-176.

⁶ Owen Lattimore, *op. cit.*, pp. 39-41, 394; Turner, *op. cit.*, p. 414; Granet, *ibid.*, p. 412.

area watched over and ruled by a walled city. Except for a small amount of long-range trade, this cellular structure was repeated indefinitely all over China and many of the features and functions remained the same both under Chou feudalism and under later imperial orders.⁷ As the tillage areas were expanded by reclamation and clearing and the barbarian frontiers pushed back, the cells and their cities grew in numbers. The number of feudatories in the Chou kingdom at one time rose to about 1100.⁸ In the more fertile parts it was not more than a day's walk from one city to the next.⁹ Thus, in what was fundamentally an agricultural economy, the walled city became an essential feature of the landscape. Fertilizer obtained from the city made its periurban area the most intensively cultivated and highly productive part of the tributary rural area.

Not only was the walled "city in the country" an administrative and military feudal center; it took on increasingly important trade and commercial functions as well. To a large extent trade moved in short range circuits within the unitary city-and-country cell.¹⁰ From the unwalled farm villages in the tributary area there moved toward the city large amounts of produce for immediate consumption, as well as surplus grain for storage in the city's granaries. An increased demand for luxury goods by the urban aristocrats, and a developing need for copper and tin, resulted in an increased long-range trade. A relatively few items such as salt, iron, tea, and silk, as well as the copper and tin just mentioned, which were produced in restricted areas, formed the basis of the intercellular trade.¹¹ With the growing demand for luxury goods there came an increase in the number of artisans and merchants within the cities. Simultaneously the urban settlements increased relatively in commercial and industrial functions. In the *Shih Chi* is found the following statement concerning Shih Shih, a merchant of Loyang during the Chou dynasty: "He used carts by the hundreds and traded in every province and state [kingdom?], leaving no place unreached."¹²

The seigniorial town or city of the feudal period of Chou was more than an administrative and trade center however. It was an ancestral center as well and was accorded the respect that such a center warranted. This was a third type of function. The city in many ways resembled the Holy Place in the peasant village. "The seigniorial town is the successor of the Holy Place. The Chieftan is the *double* of a sacred power, impersonal at first, which called for the reverence of a community. Materialized later, under the likeness of an ancestor, it received the worship of a hierarchized group."¹³ The village Holy Place was a site where festivals and fairs were held; there the individual communed with his native soil; there one in-

⁷ Lattimore, *op. cit.*, pp. 40-41.

⁸ Turner, *op. cit.*, p. 415.

⁹ Lattimore, *op. cit.*, p. 41.

¹⁰ *Ibid.*, p. 394.

¹¹ *Ibid.*, p. 394.

¹² *Shih Chi*, 129, 18b. *History of Chinese Society—Ch'in and Han* (unpublished manuscript), Chinese History Project, Columbia University.

¹³ Granet, *op. cit.*, p. 177.

vited his ancestors to come and be reincarnated. As the successor of the village Holy Place, the sanctity of the latter descended intact to both the Lord and his City. This sanctity was embodied in the person of the overlord, in the Altar of the Soil, in the Ancestral Temple, and in the ramparts and gates of the city.¹⁴

The founding of a seigniorial town was done with great ceremony. The founding noble, in full dress and wearing all his jewels and jades and bearing a magnificent sword, first inspected the countryside to select a proper site. Shadows were studied to determine the cardinal points of the compass. He examined the declivities in sun and shade. Account was taken of the direction of running water. Finally the tortoise was consulted to determine whether the previous calculations were correct. Once the site was settled the order was given to build and a colossal army of builders was set to work so that the city took form with great speed. Building usually began in the tenth month when the season of most active rural labor was past, and at the winter solstice the work was obliged to be completed. First to be constructed were the ramparts or walls for these were the most sacred element of the town. Less important towns in the feudal hierarchy had walls of tamped earth; in those of higher rank they were often of masonry. Moats encompassed the walls to give further protection. In the ideal square town gates flanked by wooden towers breached the walls at their mid points resulting in a main north-south and a main east-west thoroughfare across the city. The construction of gates and walls was of great importance for the divinity of the city was lodged in its ramparts and their gates. A city acknowledged its defeat when the besieger was able to plant his standard upon the walls of the beleaguered town. Both the dignity of the lord and of his town are clearly to be observed in the ramparts of the city.¹⁵

After the erection of the walls and gates there followed the construction of the Ancestral Temple and the Altar of the Soil. The latter was formed by a simple elevation of beaten earth, square in shape. Trees were planted to make the sacred forest. The Temple of the Ancestors varied from humble earthen edifices with thatched roofs, to magnificent structures with tall pointed columns, carved rafters, and curved roofs. The residence of the lord likewise varied greatly in size and sumptuousness with a tendency toward increasing magnificence in the latter part of the feudal period as a few states waxed greatly in power. In the ideal city the lord's residence was at the exact center. Like the town it was square and surrounded by walls so that it was a town in itself. Resembling the lord's residence, those of the great families within the city were likewise surrounded by walls and each was a town in miniature. The cities' buildings were greatly crowded against one another so that the congestion made the danger from fire very great. "It was a problem how to obtain a little air, for shops, either private or owned by the overlord, emporiums of archives, arsenals, stables, temples, and harems, were jumbled against each other."¹⁶

¹⁴ *Ibid.*, pp. 176-177.

¹⁵ *Ibid.*, pp. 237-239.

¹⁶ *Ibid.*, p. 243.

Closely associated with the urban functions of administration, trade, and ancestral center were those which made the Chinese city an important repository and main-spring of culture. Here were concentrated the libraries, the scholars, the artists, the temples, and in addition the people with sufficient wealth and leisure to promote and cultivate the arts.

Thus, the walled city of ancient feudal China was multi-functional in character. Primarily it was a political-military center. Auxiliary functions were those associated with processing and trade, the ancestral holy place, and the "dynamic workshop in which changing culture patterns were forged, revamped, renovated and reassorted."

City Development under Ch'in and Han (256 B.C.-220 A.D.)

Under the Ch'in and Han dynasties which followed Chou, and persisted for nearly 450 years, China was greatly expanded areally, while at the same time its political and military organization was changed from one of feudal separatism to that of imperial unification. Under Ch'in the country was divided politically into 36 chun or commanderies and the latter subdivided into prefectures or hsien. This new governmental organization was reflected in urban modifications of some consequence. Of significance was the system of ranks and orders which came to prevail among cities. The rank of a particular city originally had little relationship to its size or commercial importance. Its position was determined exclusively by the rank of the administrative official who resided there. Not infrequently cities of high rank, such as capitals of commanderies, were inferior in population and sometimes in wealth to capitals of hsien which were lower in the political hierarchy. Most cities of ancient China possessed political or military functions and it was probably rare, if not unknown, for a sizable urban community to develop solely with non-administrative functions. On the other hand, there was a natural tendency for cities of high administrative rank to develop important commercial and industrial functions gradually as well, since these economies were fostered by, and closely related to, the political organization. This is indicated by the following quotation from the Book of Yin. "Any metropolitan city whose wall is more than 3000 cubits around is dangerous to the state. According to the regulations of the former kings, such a city of the 1st order can have its wall only a third as long as that of the capital; one of the 2nd order only a fifth as long and one of the least order only a ninth."¹⁷

When China ceased to be a confederation of overlordships under the suzerainty of a king, and evolved into a unified empire, there was associated with this change a great increase in the number of private fortunes of merchants and industrialists, and with this naturally, an augmented importance of the cities. The contemporary writings offer testimony relating to this multiplication and expansion of these economic functions which concentrate in urban places.

The Historical Memoirs of Ssu-ma Ch'ien are very specific in their descriptions of the growing importance of commerce and industry during the Han period and of

¹⁷ James Legge, *The Chinese Classics*. Vol. V, Part I, p. 5.

the conflict between the merchant class, on the one hand, whose growing power was based on effort and accomplishment, and the hereditary feudal nobility on the other. Even during the earlier Ch'in dynasty, Ssu, the Alien Minister at the court of the king, in his argument against the expulsion of all aliens, offers testimony to the increasing importance of trade as a function of the ancient cities. "Now Your Majesty has procured jade from K'un Shan, and possesses the treasures of Sui and Ho. You bedeck Yourself with the Bright as the Moon Pearls and wear the T'ai-o Sword. You ride the Hsien-li Horse. You erect banners (decorated with the feathers) of the kingfisher and phoenix, and set up drums made from the (skins of the) supernatural water lizard. Of these many treasures Ch'in does not produce a single one, and yet your majesty enjoys them. Why is this so?"¹⁸

From the *Shih Chi*, likewise, is obtained the following description of the trade in a large Han city. "In a hub city and big metropolis there are sold annually a thousand jars of wine, a thousand long-necked jars of pickled sauce, a thousand large jars of ordinary sauce. There are slaughtered a thousand head of oxen, sheep and pigs. There are sold (also) a thousand chung of grain, a thousand wagon loads of fuel-straw, a thousand chang of boats, a thousand logs of timber, ten thousand pieces of bamboo poles, a hundred small carriages, a thousand oxcarts, a thousand pieces of varnished woodware, a thousand chiin of bronze utensils, a thousand piculs of plain wooden and iron utensils and yellow and red pigments, two hundred horses, two hundred and fifty oxen, a thousand pairs of sheep and pigs, one hundred bondsmen, a thousand catties of tendons, horn and cinnabar, a thousand chiin of silk fabrics, floss silk, and fine cloth, a thousands bolts of patterned and colored silks, a thousand pieces of the t'o-pu, hide and leather, a thousand pecks of lacquer, a thousand i of yeast and salted bean sauce, a thousand catties of sea fish and knife fish, a thousand piculs of dry fish, a thousand chiin of dried and salted fish, thrice a thousand piculs of jujubes and chestnuts, a thousand fox and marten pelts, a thousand piculs of lambskins, a thousand felt mats, a thousand chung of other fruits and vegetables, and a thousand strings of coins loaned on interest."¹⁹ Kung Yü in his memorial as Grandee Secretary in 44 B.C. states: "The traveling and resident merchants who, seeing profits, went east, west, south and north, all employed their cleverness and skill, wore elegant clothing, and ate dainty food. In a year they made a two-tenth profit but they pay no taxes."²⁰

Evidence concerning the marked growth of the cities as centers of commerce is also provided by the following quotation from the Ch'ien-fu Lun, a book written by a noted scholar of the Later Han period. "Now all society is abandoning the fundamental agriculture and hastening to trade. Oxen, horses, wagons and carriages block the roads. Loafing hands which make skillful things fill the cities. Those

¹⁸ *Shih Chi*, 87, 2b-5b, *History of Chinese Society—Ch'in and Han* (unpublished manuscript), Chinese History Project, Columbia University.

¹⁹ *Shih Chi* 129, 2a-17a, *History of Chinese Society—Ch'in and Han* (unpublished manuscript), Chinese History Project, Columbia University.

²⁰ *Han Shu* 72, 15b. *Ibid.*

who devote themselves to the fundamentals are few while those who live parasitically are many xxx. In my estimation, in Lo-Yang of today those who are engaged in the secondary occupations are ten times as many as the farmers and the shrewd loafers are ten times as many as those who engage in the secondary occupations."²¹ It was the cities with their artisans and merchants, "the lowest of the professions," which were the first to profit by the country's unification. "That is why the rich merchants ran to and fro about the Empire; there was no object of exchange which did not go everywhere."²²

The average distance between hsien or county cities during the Han dynasty was not less than 100 li²³ and it was probably more in the case of Ch'in.²⁴ The chief forms of communication between the cities appears to have been post horses, relay carriages with several horses and ox wagons.

Throughout the feudal period which preceded the Ch'in and Han empires trade and industry were treated as the lowest of the professions. This low rank was reflected in the fact that artisans and merchants customarily were obliged to live in the suburbs of the seigniorial towns outside the walls. As these classes grew in numbers and importance they occasionally revolted against the nobility, but on the whole their inferior status was fairly well maintained. Under the Empire, the growth of fortunes associated with trade and industry was looked upon as a threat as well as a boon by the rulers. While the emperors feared the great private fortunes accumulated by the large merchants and industrialists in the cities, and attempted to retard their growth through the establishment of competing state monopolies and by other means, still the Empire in many ways came to depend to an increasing degree upon the services that only the possessors of these large fortunes could provide.²⁵

A prime reason for the development of a unified empire was the need for an adequate defense against the horsemen of the steppes. This struggle against the barbarians required a well equipped mobile army under the control of a central government which could be mobilized promptly at any threatened frontier. The strength of the imperial army was in its light cavalry which for its efficient operation required mounts, arms, forage, meat, and grain. The reclamation and populating of uncultivated lands had the effect of reducing the isolation of many sections and of bringing cities, which were the centers of social life, closer together. Within the cities central State granaries, workshops, and arsenals were developed to facilitate supplying the armies. Under a unified empire ability to promptly mobilize grain with which to feed the armies was greatly increased.²⁶

The Emperors, whether they wanted to or not, in order to strengthen the mili-

²¹ *Hou Shan Shu*, 49, 5a-b. *Ibid.*

²² Quoted from Ssu-ma Ch'ien, in Granet, *op. cit.*, p. 412.

²³ One li is about one third of a mile.

²⁴ *History of Chinese Society—Ch'in and Han*. *Ibid.*

²⁵ Granet, *op. cit.*, pp. 113-115.

²⁶ *Ibid.*, p. 411.

tary arm of the State were forced to seek the aid of the great merchants and industrialists of the cities and thus to recognize their improved position. Some of the largest fortunes were amassed by the salt merchants and the iron masters. When in the reign of Emperor Wu the Hsiung Nu barbarians attacked on the northern frontier, and local stocks of food were found insufficient to maintain the reinforced military colonies, an appeal had to be made to the merchants, who were in possession of the means of transport, for aid in organizing the movement of grain to the threatened frontiers.²⁷ Great merchants capable of organizing convoys of several hundred vehicles were rewarded not only in money but likewise by being given much cherished rank and position in the official government hierarchy. Likewise, when large groups of settlers needed transportation to the new lands opened up for colonization, the government was obliged to request aid from the merchants who alone were able to organize the necessary convoy service. Thus transport enterprise and military contracts created capital which was subsequently used in the further expansion of commerce and industry in the cities.

The requirements of the army also made necessary the breeding of sheep and horses on a large scale. Breeding projects of large magnitude created the need for extensive acreages and for numerous workers, resulting in the development of great latifundia and of slave labor to operate them. The services and monetary contributions to the State rendered by these town-dwelling, landed proprietors resulted in their being rewarded with government offices and titles also. This, in turn, improved their social position. In this way the great fortunes of the merchants, industrialists, and landlords became effective bribes by which titles of nobility might be obtained. "Thus was authorized the regrouping which placed highest in society the rich inhabitants of the cities."²⁸ "All the members of the new imperial nobility were people of the town, living close to officials from whom they could learn the rules of conduct which were becoming in official classes."²⁹ New towns, which were centers of administration and trade, and rich in new activity came into being. This new urban population was wholly separated from feudal traditions.

The only archeological evidence available by which the character of Ch'in and Han cities may be measured appears to come from Ch'ang-an, the capital of the western Han Dynasty (about 200 B.C.). The city was located about four to five miles northwest of the present Hsi-an (Sian), capital of Shensi province, in the historic Wei River valley. In general two kinds of fortified Chinese cities are recognized: 1) the acropolis or citadel type, usually occupying an elevated or otherwise strategic site, which was designed to provide a temporary strong defensive point in an emergency; and 2) the more numerous enceinte or walled city type, chiefly located on the plains, which was designed to afford more permanent protection. Ch'ang-an was of the latter type. It was one of the greatest cities of the earth in its day, far exceeding in extent and population any contemporary European

²⁷ *Ibid.*, p. 142.

²⁸ *Ibid.*, p. 415.

²⁹ *Ibid.*, p. 416.

city. Only in the Near East and in India, perhaps, did there exist urban clusters of comparable magnitude.³⁰

Since the Chinese built of wood and pounded earth little remains of the ancient Han capital, at least at the surface. Most conspicuous of the remains are portions of the city wall and what is thought to have been the foundation mound of the principal building in the imperial palace enclosure. The wall or rampart was built of solidly tamped earth. Its thickness at the base was about 350 feet. Its vertical height at present is 25 feet and originally it was higher. To this must be added the depth of the moat, 160 feet wide, which at present, although well silted, is still about 10 feet deep.³¹ Old maps indicate that the total circumferential length of the wall was 15 to 16 miles and that it was roughly quadrangular in shape. According to Miao Chi there were in Han times nine markets in Ch'ang-an. Each of the markets had a site covering 266 square paces. Six markets were on the west side of the street and three on the east. The offices of the market chiefs or supervisors were also located in the market area, the duties of these officers being to supervise the trading operations of the city's merchants.³²

CHINESE CITIES DURING THE MIDDLE AGES

The first description by European eye witnesses of the number and importance of medieval Chinese cities has come down to us from the writings of such famous travelers as the Polos, Friar Odoric, John of Marignolli, and Juan Gonzalez de Mendoza who reached the Kingdom of the Great Khan during the period of Pax Tartarica, when for a brief century the black curtain separating Europe and Asia was again lifted.³³ Through them a new world of the Far East was discovered. In fact the accounts of these travelers concerning the Chinese and their country seemed so incredible to their European readers that upon his death bed Marco Polo was urged to repudiate his fabulous report on the wonders of Cathay so that his sins of exaggeration would not be held too seriously against him in the next world. He did not recant. Among the most impressive of the wonders reported by each and all of these travelers was the number, size, and luxury of the Chinese cities. In fact, Marco Polo's account is to a fair degree taken up with a description of the wonders of Chinese urban life experienced on his travels. Time after time he repeats in a variety of ways the following general theme: "When one sets out from ——— he goes riding three days marches by midday, always finding many cities and villages noble and good and rich and of great trade and full of merchants, and of great crafts."³⁴

³⁰ Carl Whiting Bishop, "An Ancient Chinese Capital; Earthworks at Old Ch'ang-an," *Annual Report of the Smithsonian Institution*, 1938, p. 570.

³¹ *Ibid.*, pp. 570-571.

³² *History of Chinese Society—Ch'in and Han* (unpublished manuscript), Chinese History Project, Columbia University.

³³ A faint glimpse of urban development in medieval China during the Liao period (907-1125 A.D.) is furnished by widely scattered and brief comments in, Karl L. Wittfogel and Chia-Sheng Feng, "History of Chinese Society—Liao," *Transactions of the American Philosophical Society*, XXXVI (1946).

³⁴ A. C. Moule and Paul Pelliot, *Marco Polo—The Description of the World*. p. 306.

So much is Polo impressed by the urban luxury and activity that his account is distinctly lacking in any serious description of the rural countryside.

Concerning the number of Chinese cities Polo writes: "For I tell you there is no doubt that in the vast province of Manzi³⁵ are altogether quite 1200 cities, besides castles and towns of which there is a great quantity, all fair and rich. . . ."³⁶ Juan Gonzalez de Mendoza, in the late 1500's, estimates the number of cities and towns in each of the 15 provinces. His totals for the entire country are 591 cities and 1593 towns.³⁷ While these estimates cannot be taken too literally, they are at least suggestive.

Polo's most detailed and lavish descriptions are reserved for the Khan's capital, Cambaluc (Pei-p'ing) and of Quinsai (Hang-chou). The new Cambaluc (Taidu), which had been built by the Khan across the river from the older city, was 24 miles around and exactly square. It was surrounded by embattled walls 10 paces thick at the base and twenty high. There were 12 principal gates, three on each side of the city. Above each gate and at each corner of the wall was "a very large palace and fair" where dwelled the troops who guarded the city. Broad main streets crossed the city at right angles, each terminating at a gate. Outside the city at each of the 12 gates were suburbs, "which are very large so that the suburb of each gate touches the suburbs of the gates on either side, and they extend for a length of three and four miles; and there is no man who could tell the number. For there are many more people in those suburbs than in the town. And in each of these suburbs or districts for perhaps a mile distant from the city are many and fine factories in which stay and lodge the merchants and the traveling foreigners, of whom there are many from all parts to bring things as presents to the lord and to sell to the court. . . . Moreover I tell you that there are as beautiful houses and as beautiful palaces in the suburbs as in the town, except those of the greatest lord."³⁸

Polo continues with a description of the great commerce which focused upon the Khan's capital:

" . . . And again you may know quite truly that I believe there is not a place in the world to which so many merchants come and that dearer things and of greater value and more strange come into this town of Cambaluc from all sides than into any city of the world, and greater quantity of all things, and I will tell you what. First of all [I shall tell] you that all the dear things that come from Indie, these are precious stones and pearls, and silk and all the spicery, and all other dear things, are brought to this town. And again all the beautiful things and all the dear which are in the province of Catai and from Manzi and from all other provinces round about are brought there also. And this happens because everyone from everywhere brings there for the lord who lives there and for his court and for the city which is so great and for the ladies and for the barons and the knights of whom there are so many and for the great abundance of the multitude of the people of the armies of the lord, which stay round about as well for the court as for the city, and of other people who come there by reason of the court

³⁵ South China—to distinguish it from Cathay in the north.

³⁶ *Ibid.*, p. 335.

³⁷ Juan Gonzalez de Mendoza, *The History of the Great and Mighty Kingdom of China*, Sir George T. Staunton, Ed. The Hakluyt Society. Vol. XIV, pp. 23-24.

³⁸ Moule and Pelliot, *op. cit.*, pp. 235-236.

which the great lord holds there, and for one and for another; and because the city is in too good a position and is in the middle of many provinces. And for this reason which I have told you more dear things and of greater value come to this town and greater quantities than into any town in the world, and more goods are sold and bought there than in any other city, so that so much of everything comes there that it is without end. For you may know in truth that among the rest, almost each day in the year there come into this town more than a thousand carts loaded with silk alone, for many cloths of gold and of silk are made there and many other things. . . . And again this city of Cambaluc has round it infinite villages and more than two hundred other cities both far and near which come, the people of these towns, from a distance of 200 miles to buy many things in this city, and from there they have the things which are needed for them, and live for the most part while the court is here by selling the things needful to the city."³⁹

Polo's superlatives are reserved for Hang-chou (Quinsai) south of the Yangtze in Chekiang province, the capital of the Sung Dynasty. ". . . then one finds the very noble and magnificent city which for its excellence, importance and beauty is called Quinsai, which means to say in French the city of Heaven, xx, for it is the greatest city which may be found in the world, where so many pleasures may be found that one fancies himself to be in Paradise."⁴⁰ The market squares, streets, and canals were wide and spacious and the whole city had an approximate circumference of about 100 miles. Twelve thousand bridges, most of them stone, arched the numerous rivers and canals. There were ten principal open spaces or market squares, each half a mile on a side. ". . . and along the front of those there is a main street forty paces wide, which runs straight from one end of the city to the other with many bridges which cross it level and conveniently; and every four miles is found one of these squares such as have two [miles] of circuit."⁴¹ A broad canal paralleled the main street back of the squares, on whose bank were built large stone houses, "where all the merchants who come from Indie and other parts deposit their goods and merchandise that they may be near and handy to the squares."⁴² On three days a week forty to fifty thousand persons occupied these market squares and offered materials for sale. "All the said ten squares are surrounded by high houses, and underneath are shops where they work at all sort of trades, and sell all sorts of merchandise. . . ."⁴³ Individual streets about the market squares were given over to the courtesans, physicians, astrologers and "infinite other trades."

Along the principal street were also the shops and houses of the artisans. Quinsai was said to have twelve major trades or crafts and multitudes of smaller ones. Each of the 12 crafts had 12,000 trading stations, with ten to forty men in each.⁴⁴ ". . . there are so many merchants and so rich, who do so much and so great trade, that there is not a man who could say or tell the truth about them that should be

³⁹ *Ibid.*, pp. 236-237.

⁴⁰ *Ibid.*, p. 326.

⁴¹ *Ibid.*, pp. 327-328.

⁴² *Ibid.*, p. 328.

⁴³ *Ibid.*, p. 328.

⁴⁴ *Ibid.*, p. 329.

believed, they are so extraordinary a thing."⁴⁵ Sixty thousand guards protected the city from fire. All the streets in the town were paved with cut stones or baked bricks so that the whole city was very clean. Polo estimates that there were 1,600,000 houses in Quinsai.⁴⁶ Since Quinsai was at that time the capital of one of the nine kingdoms into which the Tartars had divided the country, it had 120 cities under it.

Like his predecessor, Marco Polo, Friar Odoric who visited China in the early part of the fourteenth century was greatly impressed with the number, luxury, and trade of the cities of the country. Manzi (South China) alone, according to Odoric's account, contained 2000 great cities, ". . . cities I mean of such magnitude that neither Treviso or Vicenza would be entitled to be numbered among them."⁴⁷ Concerning Censcalan (probably Canton) where he landed he has the following to say: ". . . and 'tis as big as three Venices. . . . And this city hath shipping so great and vast in amount that to some it would seem well nigh incredible. Indeed all Italy hath not the amount of craft that this one city hath."⁴⁸ Like Polo, Friar Odoric reserved his greatest praise for Campsay (Hang-chou):

"And 'tis the greatest city in the whole world. . . . It is a good hundred miles in compass, and there is not in it a span of ground which is not well peopled. And many a tenement is there which shall have ten or twelve households comprised in it. And there be also great suburbs which contain a greater production than even the city itself. For the city hath twelve chief gates and from each of them cities extend to a distance of some eight miles, each one greater than Venice is or Padua. So that you for six or seven days travel continually about one of these suburbs and yet shall you seem to have gone but a very little way."⁴⁹

John of Marignolli, Papal Legate to the Court of the Great Khan in the first half of the fourteenth century, seems to have been given to exaggeration to a degree unbecoming a churchman. Like the other travelers of the time in China it was the cities of the Far East that excited his imagination most. He writes:

"Now Manzi⁵⁰ is a country which has countless cities and nations included in it, past all belief to one who has not seen them. . . . Indeed it has 30,000 great cities besides towns and boroughs quite beyond count. And among the rest is that most famous city of Campsay,⁵¹ the finest, the biggest, the richest, the most populous, and altogether the most marvelous city, the city of the greatest wealth and luxury, and of the most splendid buildings xxx that exist now upon the face of the earth, or mayhap that ever did exist."⁵²

Rashiduddin, who likewise was in China during the first half of the fourteenth century, wrote at some length concerning the hierarchy of Chinese cities.

"In this empire of Cathay there are many considerable cities; each has its appropriate title

⁴⁵ *Ibid.*, pp. 329-330.

⁴⁶ *Ibid.*, p. 339.

⁴⁷ Colonel Henry Yule, *Cathay and the Way Thither*, Vols. I, II. The Hakluyt Society, London. Vols. 36, 37, A. pp. 103-104.

⁴⁸ *Ibid.*, p. 106.

⁴⁹ *Ibid.*, pp. 114-115.

⁵⁰ South China, as distinguished from Cathay or North China.

⁵¹ Hang-chou.

⁵² *Ibid.*, p. 354.

marking a particular rank in the scale. The relative precedence of governors is indicated by that of the cities which they administer, so that there is no need to specify their dignities in the diploma of appointment, or to enter into curious questions of precedence. You know at once (by the rank of the cities to which they are attached) which ought to make way for another or to bow the knee before him.

A similar classification of governors according to the rank of their cities does not exist anywhere, but the empire of Cathay is quite remarkable for the system with which it is organized."⁵³

From the accounts of the European travelers one gathers that the cities of medieval China were probably centers of craft industry and of trade to an extent not known in the cities of the China of antiquity. The large areas in the cities occupied by the craftsmen and the merchants, their fine homes and establishments, the great number of boats on the rivers and in the harbors, and the general wealth and luxury in the cities, all give evidence of an enlargement of the commercial and industrial functions of the urban centers over that which prevailed in Ch'in and Han times. The very size and population of the cities are additional evidence. Still, in all probability, most of the cities owed their size and wealth in part to the political functions. The vast army of government officials and of troops stationed at the cities of various ranks was one of the prime reasons for the trade and industry that thrived in these centers. Originally and primarily political centers, they had continued to retain that important function throughout the centuries. Serving the needs of the government, however, and at the same time thriving upon the government bureaucracy, there had been developed a large and wealthy group of merchants and industrialists. Thus the medieval Chinese cities became in addition to political centers, great marts of trade and industry which provided large revenues to the great lord. Polo, speaking of Quinsai, states, ". . . the great Khan has great revenue and great duties from it, so great that whoever heard it said could hardly believe it, and so greater and more anxious care is spent on it."⁵⁴

Because of the immense wealth that came to be concentrated in the hands of merchants and traders in the cities, the latter also developed into centers of luxury and pleasant living. Polo was greatly impressed with Quinsai as a town where the art of personal enjoyment was developed to an unusual degree. He speaks of the 3000 artificial baths boasted by the city, its endless number of luxurious carriages "furnished with hangings and cushions of silk," the beautiful gardens, the magnificent lake-shore homes resembling palaces, and the multitudes of pleasure boats and barges on the lake built exclusively for feasting and enjoyment.⁵⁵ These same centers of luxury and wealth were also the points of concentration of cultured people where the arts and letters flourished. Here were men of wealth and a government bureaucracy to serve as patrons of culture and here as well were the libraries, archives, schools, and temples which provided materials and personnel. Polo and his contemporary travelers from foreign lands were so blinded by the material opulence

⁵³ *Ibid.*, p. 263.

⁵⁴ Moule and Pelliot, *op. cit.*, p. 333.

⁵⁵ *Ibid.*, pp. 331-332.

of the cities that they were unappreciative of the role of China's urban centers as repositories of culture.

CHINESE CITIES IN THE MODERN PERIOD

It seems likely that Chinese cities did not change fundamentally in functions and form from the period when Polo and Odoric reported on their numbers and magnificence down to about the middle of the 19th century when western influences began to enforce some modifications. In fact the late medieval period may have seen the cities at pretty much their peak in splendor and prosperity. Prior to about 1500 China encouraged foreign commerce in all parts of her territory. There was no policy of seclusion and no laws restricting the movements or operations of foreigners. This attitude was reflected in the cosmopolitan commerce of her cities. After the early 16th century, however, and down to the opening of the treaty ports in about the middle of the last century, China pursued a restrictive and more or less exclusive policy in dealing with foreigners. This was the period of the "closed door." The general effect upon city growth and expansion was a repressive one. In addition it had developed as the official policy of the ruling landlord bureaucracy to restrict the growth of merchant capital by promptly declaring any important profitable enterprise a state monopoly and absorbing the embryonic merchant class into their ranks.⁵⁶ The result was that insufficient capital remained in the hands of the people for the development of important trade and industrial enterprises. Any enterprise larger than that which might be organized by the co-operative efforts of the peasants of a single village required the interference of the magistrate. As a result the cities to an increasing degree came to depend upon the functioning of the bureaucracy. It is altogether possible then that Chinese cities were visibly less prosperous and smaller in size in 1800 or 1850 than they were in Polo's and Odoric's time. Certainly the reports of foreign travelers concerning Chinese cities in the 19th century are by no means as enthusiastic as were those of their medieval counterparts.

Functions of Modern Chinese Cities

Since ancient times it appears there have been two primary forces in China stimulating the development and growth of cities. These are: 1) the dynastic or administrative factor, and 2) the economic factor, both a) local and b) regional.⁵⁷ One or more of the above has been touched upon previously in the treatment of cities during earlier periods, but it remains here to summarize and elaborate their role in the functioning of modern cities.

The dynastic factor as a stimulator of urban growth operated in two directions: a) administration and b) defense. Probably in no other country has political influence in city development operated in such pure fashion, and, at the same time,

⁵⁶ Ch'ao-Ting Chi, *Key Economic Areas in Chinese History*. p. 70.

⁵⁷ Ernest Tiessen, "Die chinesische Stadt: eine siedlungskundliche Studie," *Deutsche geographische Blätter*, XXXV (1912): 1-19.

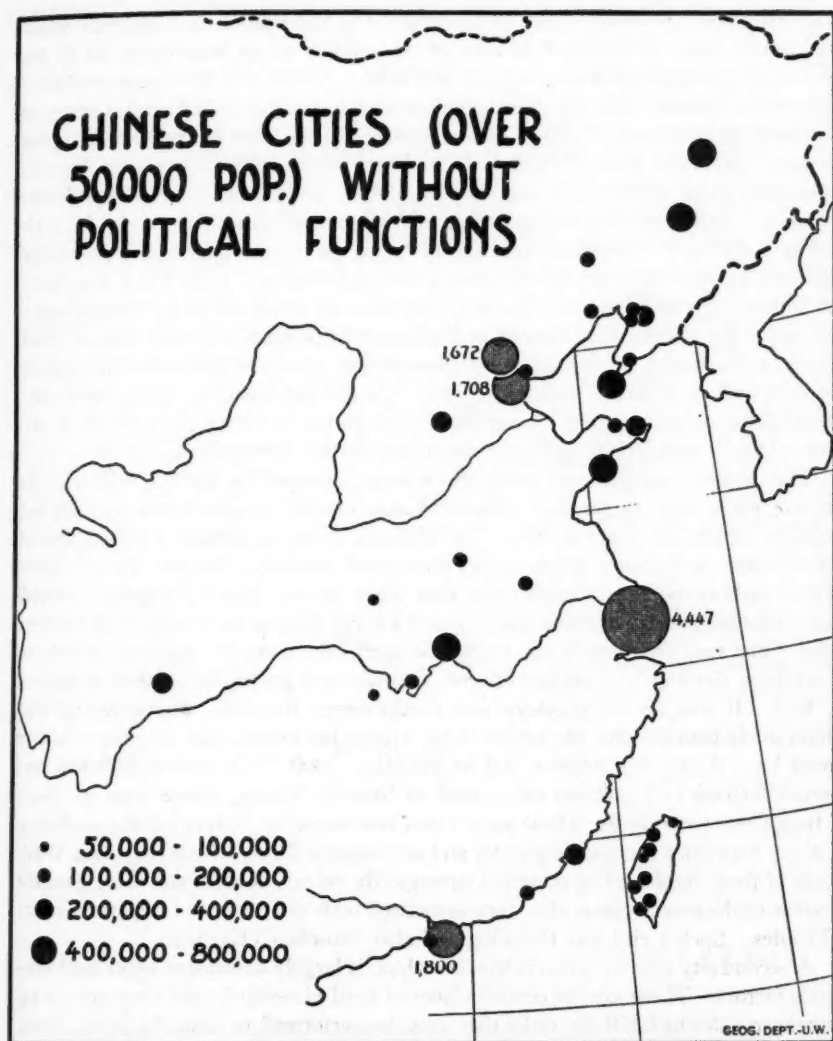


FIG. 1. A great majority of Chinese cities have administrative functions and owe their origin and development, at least in part, to that function.

so strongly and so continuously through the centuries, as in China. Relatively few Chinese cities are without administrative functions (Fig. 1). It is only within the last 50 or 100 years that the original Chinese concept of a city as the seat of a public official, and the visible evidence of which was the city wall, has been significantly

modified. As mentioned earlier in the paper, the importance of a city was measured not so much in terms of its area or the number of its inhabitants, as by the rank of the government official who resided there. To be sure there were nucleated settlements without walls, the so-called *chen*, which sometimes had several scores of thousands of inhabitants, but by Chinese standards these were not real cities. Quite naturally, however, there tended to be a direct relationship between the bureaucratic rank of an urban center and its general size, magnificence, and economic importance. Indirectly the administrative factor operated to prosper a city in trade and industry for the officials were a luxury-loving group and their presence in large numbers required many people for service and maintenance. In addition, they were the patrons of science, art, and literature so that they attracted many "hangers-on." To supply the bureaucracy's needs and whims necessitated the operations of great numbers of artisans, merchants, and traders so that the cities tended to concentrate these secondary economic functions. The dynastic influence in city growth continued to be maintained and strengthened through the tendency of the State to absorb profitable enterprises and make them government monopolies.

The military and strategic factor was visibly portrayed by the city wall with its massive gates and its garrison towers. Local defense requirements necessitated walls for nearly all Chinese cities. In addition, national defense required special defense cities on the most dynamic and threatened frontiers. The maritime frontier offered little or no threat until a late date when the occidental foreigners arrived from overseas, and by that time the city wall offered little protection against modern arms. The land frontiers to the south and southwest were less exposed, and here in addition the highland masses offered some natural protection against invasions by land. It was on the northern and northwestern frontiers, where agricultural China made contact with the realm of the steppe horsemen, that the most serious threat lay. Along this frontier and its guardian Great Wall were established numerous fortress and garrison cities, such as those in Kansu, where large numbers of troops were stationed. These same cities functioned as centers for the exchange of goods between the nomadic peoples and agricultural China within the Great Wall. Some of these border cities occupied strategically defensible sites and were genuine fortress settlements. Some also were associated with the control of important natural routes. Such a city was Pei-p'ing and also Lan-chou (Kansu).

A second city type in China is the one which is largely dependent upon local economic factors. These are the central places of local hinterlands and they are set up by countrysides to fulfill the tasks that must be performed in central places. They are literally the head offices of local areas. Throughout the extensive plains of China such urban centers are distributed rather widely and uniformly, where they are the marketing centers for tributary agricultural areas of somewhat similar size. The local economic factor appears most conspicuous where the city is situated within an area of specialized production—mineral, agricultural, or other (Fig. 2). Thus Fu-shun and Pen-ch'i in Manchuria and Po-shan in Shantung are supported in large part by coal mines, while Ta-yeh in Hupeh and An-shan in Manchuria are

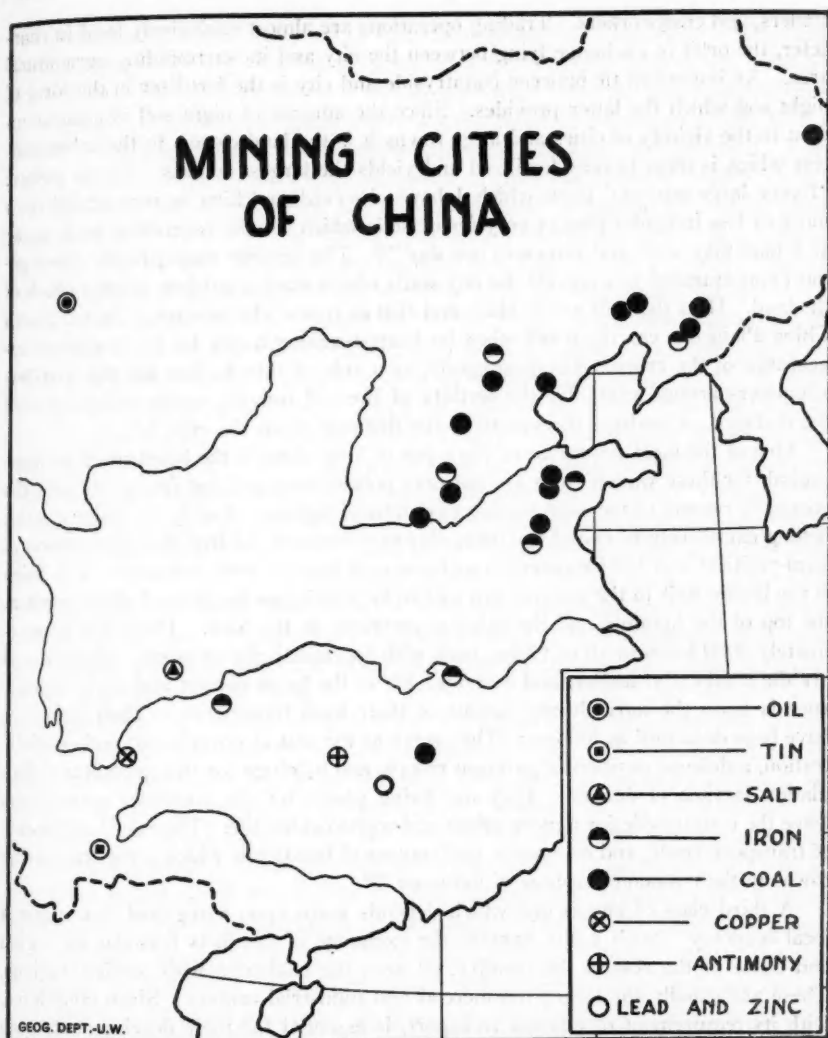


FIG. 2. Illustrating a type of city in China whose origin is associated with a local economic factor, viz., mineral production.

iron mining settlements. Much the larger number of local cities serve general agricultural hinterlands, however. Many of them are so closely identified with the adjacent countryside that they resemble giant farm towns rather than cities. In such urban places farmers, gardeners, and field workers live alongside officials, artisans,

traders, and craftworkers. Trading operations are almost exclusively local in character, the orbit of exchange lying between the city and its surrounding agricultural area. An important tie between countryside and city is the fertilizer in the form of night soil which the latter provides. Since the amount of night soil is most abundant in the vicinity of cities and large towns it is the land closest to the urban centers which is most heavily fertilized and yields the largest returns. Thorp writes: "Every large city and town which I have observed in China is surrounded by a more or less irregular ring of very fertile soils which usually extends at least as far as a man may walk and return in one day."⁵⁸ The fertility rings around cities are most concentrated just outside the city walls where market gardens occupy much of the land. Here the soils are as black and rich as typical chernozems. On the North China Plain one can often tell when he is approaching a city by the improved appearance of the crops. Thorp suggests, as a rule of thumb, that for the first few kilometers around each city the fertility of the soil roughly varies inversely with the distance, or perhaps the square of the distance, from the city.⁵⁹

One of the most numerous of the types of local cities is the hsien town or hsien capital, for these walled cities are not only political centers, but frequently also the economic centers of the surrounding agricultural regions. Rarely do Chinese cities belong exclusively to one of the three classes mentioned, so that the combination of local-political and local-economic functions in a town is very common. The hsien is the lowest unit in the government hierarchy which has the central government at the top of the pyramid and the hsien government at the base. There are approximately 2000 hsien in all of China, each with its capital city or town. These towns are the center of transport and economic life in the hsien district and their dependence is upon the agricultural surplus of their local hinterlands. Their functions have been described as follows: "They serve as the seat of government and administration, a defense position of garrison troops, and a refuge for the agricultural population in time of danger. They are living places for the wealthier gentry who leave the countryside for a more urban and sophisticated life. They are focal points of transport, trade, and commerce, and centers of handicraft which serve the market towns in their economic sphere of influence."⁶⁰

A third class of city is one which depends more upon a regional than upon a local economy. Such a city handles the exchange of products between its region and those of the rest of the country, or even the exchange with foreign regions. These are usually the larger commercial and industrial centers. Since commerce, with its requirement of efficient transport, is essential for their development, such cities must be served by something better than local transport facilities. In China water routes are of highest importance (Fig. 3). Making use of the seaway are the numerous coastal ports, many of them of great age. In this class are Fu-Chou

⁵⁸ James Thorp, *Geography of the Soils of China*. p. 431.

⁵⁹ *Ibid.*, p. 432.

⁶⁰ Doak Barnett, *Notes on Local Government in Szechuan*. Report No. 15 submitted to the Institute of Current World Affairs. p. 38.

(Foochow), Shan-t'ou (Swatow), Hsia-men (Amoy), Yung-Chia (Wenchow) serving the coastal strip between the great nodal ports of Shanghai to the north and Hong Kong-Canton to the south. Inland waterways likewise have fostered urban development, and since navigable rivers are far more numerous in South than in North China it is in the former region that riverine cities are most plentiful. Foremost among the inland waterways in its power to attract cities is the mighty Yangtze and its main tributaries, boasting such metropolises as Shang-hai, Nan-ching (Nanking), and the Wu-Han conurbation (Han-kow, Wu-chang, Han-yang) (Figs. 3 and 4). T'ien-ching (Tientsin) on the Hai and Kuang-chou (Canton) near the mouth of the Si-kiang are other riverine ports. The fluctuating and shallow Huang offers no attraction to cities. Along the Grand Canal, on the other hand, several cities have originated and developed. South of the Yangtze two linear concentrations of towns follow the tributary valleys of the Hsiang and the Kan. In South China a great majority of cities are along the coast, or on rivers or canals (Fig. 3). The two greatest urban clusters are in the Yangtze and the Canton deltas. Cargo-breaking points along rivers, where a change from one size boat to another is necessary, are particularly favorable locations for city development. Ch'ung-ch'ing (Chungking), I-ch'ang, and Han-k'ou on the Yangtze are thus located. There were until recently about 13 treaty ports in the Yangtze Valley and at each of these ports steam-diesel and native shipping made contact. As the Yangtze Valley trade has been mainly by water, transshipment and entrepôt trade centers show a high degree of development. Frequently it is possible to gauge the functional importance of many interior towns more accurately by the volume of shipping on the river than by the appearance of the town.⁶¹

Land routes, by comparison with water, have been much less influential in stimulating the development of regional cities in China. On the North China Plain the roads radiating out from imperial Pei-p'ing connected the principal cities of that populous region. Here navigable rivers are infrequent. A row of moderately important oases cities coincides with the western end of the Old Silk Road through the Kansu Corridor. Here are Wu-wei (Liangchow), Chang-yeh (Kanchow), and Chiu-ch'üan (Suchow). Modern rail development, concentrated chiefly in North China, including Manchuria, has been effective in the development of several cities, among them Ch'ing-yüan (Paoting), Chi-nan (Tsinan) and T'ung-shan (Süchow) on the North China Plain. Most of the cities of Manchuria are dependent upon rail transport and many of them are the products of the rails (Figs. 4 and 5).

As indicated previously, it is not possible to place each Chinese city within a single one of the three major functional classes named above. Only in rare instances does a city fall exclusively into one or another of these classes. Even the smaller cities are likely to be both political and local trade centers. Larger places have in

⁶¹ Joseph E. Spencer, "Trade and Transshipment in the Yangtze Valley," *Geographical Review*, XXVIII (Jan. 1938): 117.

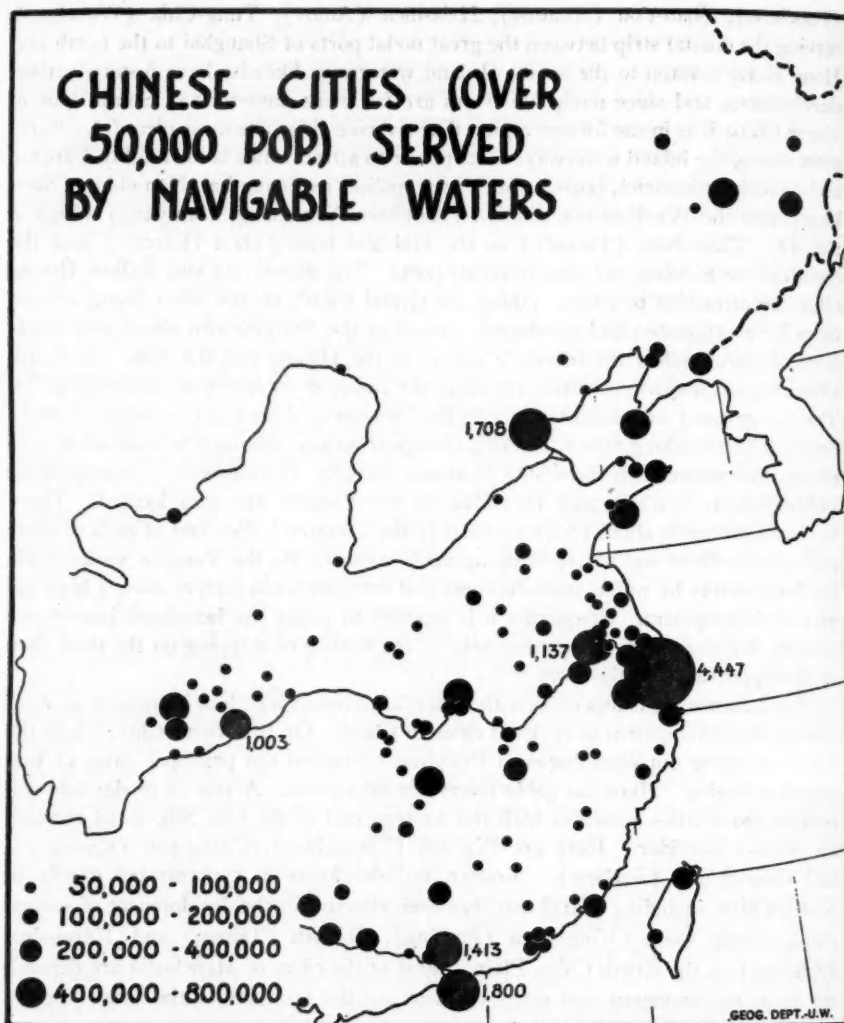


FIG. 3. A great majority of the larger cities of China, and many of the smaller ones as well, have developed along navigable waterways. Approximately two thirds have coastal or riverine location. In South China, even most of the cities depending upon local economic factors, rely on rivers and canals as a means of connection with their local supporting areas. Cities in North China depend to a much less degree upon inland waterways.

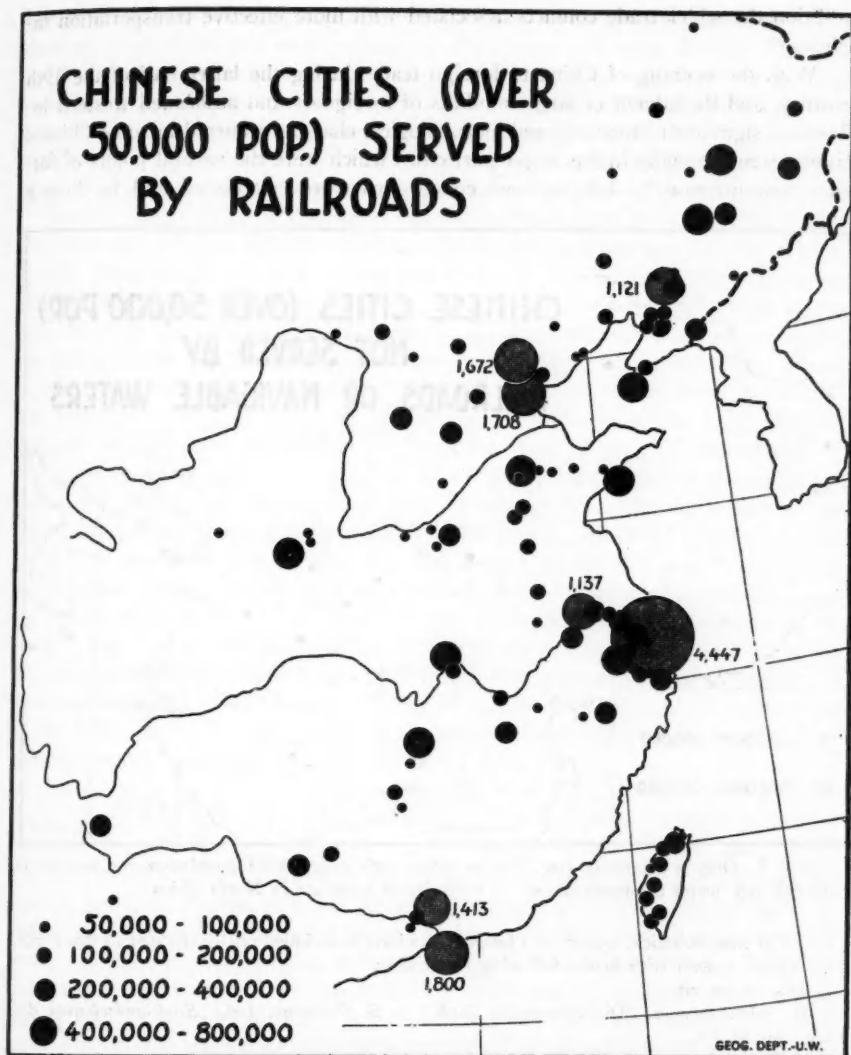


FIG. 4. Only 40 per cent of Chinese cities with over 50,000 population are served by railroads. This stands in marked contrast to the situation in Anglo America and Europe. Many of the rail lines in China, possessed with few branch lines, do not provide efficient service to the cities located on them.

addition the wider trade contacts associated with more effective transportation facilities.⁶²

With the opening of China to foreign trade during the latter half of the 19th century, and the advent of large numbers of foreigners and associated western influences, significant functional and morphological changes occurred in some Chinese cities, more especially in the larger port cities which were the natural points of foreign concentration.⁶³ International concessions were established and in these a

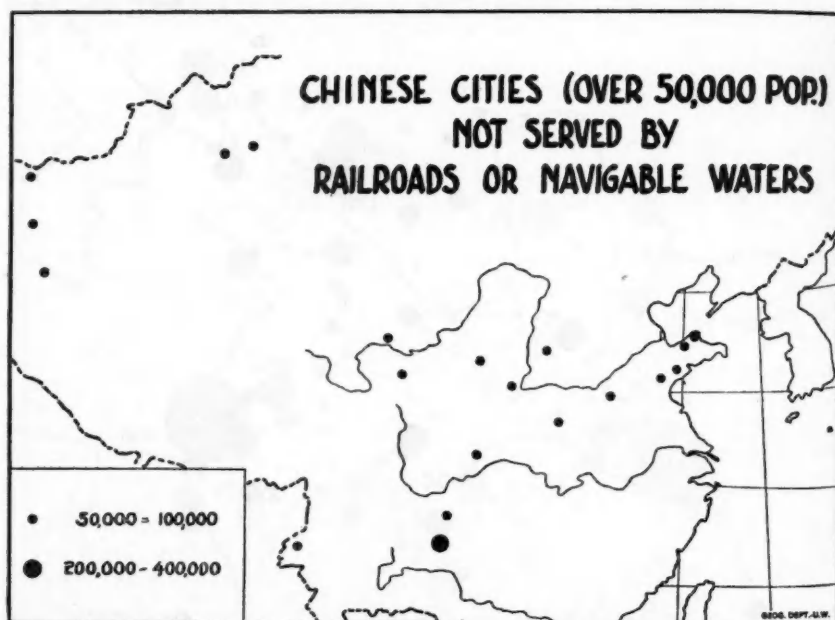


FIG. 5. Only a relatively few Chinese cities with over 50,000 population are lacking in both rail and water communications. A majority of these are in North China.

⁶² The morphological aspects of Chinese cities have been intentionally slighted in this paper. This aspect is dealt with in the following references:

Tiessen, *op. cit.*

H. Schmitthenner, "Die chinesische Stadt," in S. Passarge, (ed.) *Stadtlandschaften der Erde*. pp. 85-108.

H. Schmitthenner, *Chinesische Landschaften und Städte*.

G. Wegener, "Das chinesische Reich," in *Handbuch der geographischen Wissenschaft, Nord-asien, Zentral und Ostasien*. pp. 376-380.

Tsao Lien En, *Chinese Cities, A Geographical Reader*. Shanghai, 1931.

Joseph E. Spencer, "The Houses of the Chinese," *Geographical Review*, XXXVII (1947): 254-273.

⁶³ For a general description of important cities of China see, Tsao Lien En, *Chinese Cities, A Geographical Reader*. Shanghai, 1931.

little bit of the Occident was transported to China. Foreign-style residences and places of business led to a transformation of these restricted areas to such a degree that their appearance was completely un-Chinese. In some instances the foreign settlement was removed somewhat from the old Chinese walled city, with the result that a new nuclear area was created which developed into a new and thriving suburb. This segregation of the westerners was due, in part, to the fact that the Chinese did not want, or even permit, the foreigners to reside within the walled city.

In many instances the old walled town was set back from the river a short distance in order to escape the floods, or from the immediate coast as a protection from pirates. After the arrival of the foreigners, and with the associated development of foreign trade requiring improved port facilities, the walled city, set back as it was from the river was handicapped in its maritime operations, so that a new commercial suburb developed along the immediate river bank or coast. Fu-Chou (Foo-chow) illustrates the point in question (Fig. 6). The old walled city is at present removed some three miles from the Min River. It is possible that at one time its southern part did front upon the Min. However this may be, a new suburban area has grown up along the north side of the Min which contains the newer commercial and industrial district. Here are the wharves and piers, foreign establishments of petroleum companies, and a number of industrial plants. Since the Chinese refused to let foreigners live in the walled city the western merchants located on Nantai Island south of the river to establish a third nucleus. The foreign consulates and residences subsequently located there as well so that it became the foreign settlement. Thus modern Fu-chou consists of the old original walled city removed from the river and the two more recent settlements, stemming from new functions occasioned by foreign contacts, one on the north bank and the other on the south bank of the Min River. In many respects the situation described above for Fu-chou, prevails also at Hsia-men (Amoy).

The modern era, with its increasingly greater Occidental influence, has in other ways changed the functions and appearance of Chinese cities. This is especially true of the larger ones which have had active commercial connections with Europe and the United States. In parts of these cities the demands for modern factory industry, improved hygiene, and traffic conditions have completely changed the old Chinese features. Modern factories, storehouses, business places, occidental-style hotels, and even dwellings, have replaced the typical Chinese structures. The bund at Shanghai is a first class example of an extreme case of westernization. Broad streets for fast motor traffic have been cut through parts of the ancient cities. In some, even the old walls have been razed to give room for modernization. It should be noted that this modernizing of Chinese cities is by no means always due to the presence of large numbers of foreigners, for frequently the initiative and direction of the planning and reconstruction have been completely in the hands of the Chinese themselves. The treaty ports, chosen in the first place because of their better transportation facilities and trade hinterlands, have tended to grow faster and be more rapidly westernized than the others. Railroads, a foreign innovation, likewise modi-

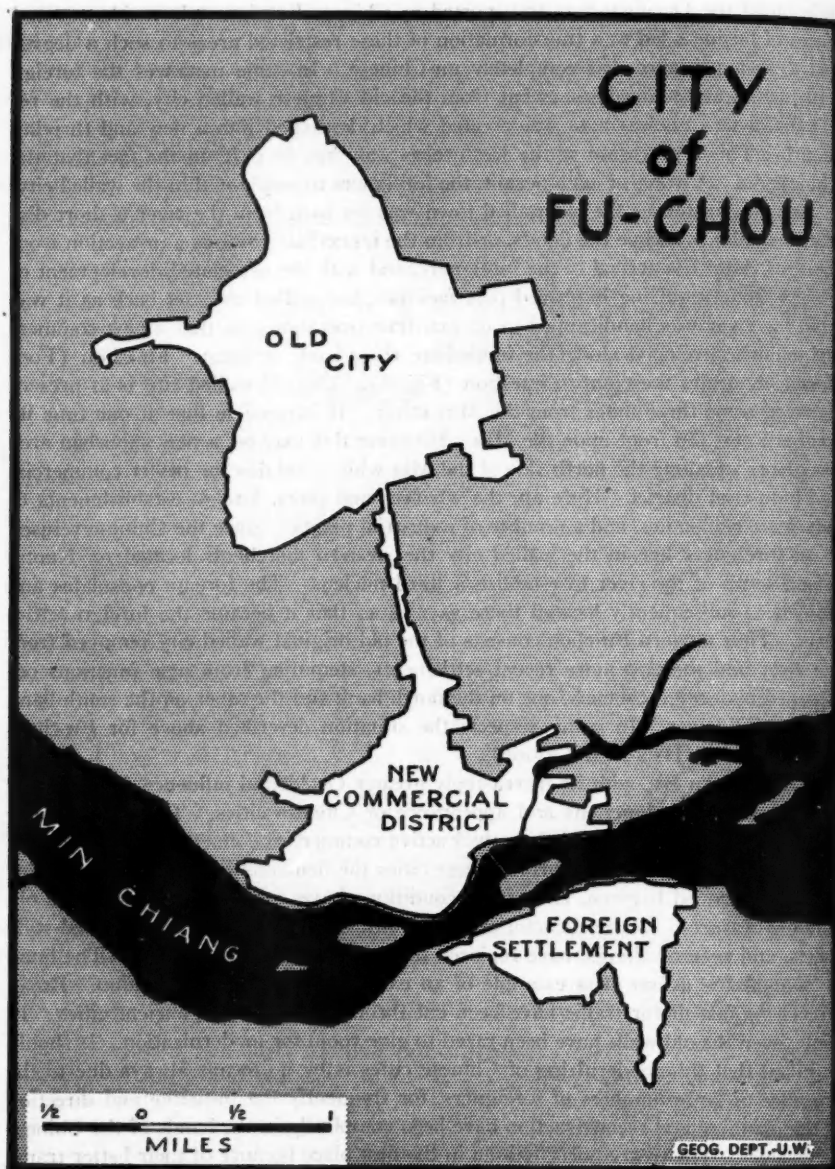


FIG. 6. In order to accommodate foreign trade carried on in relatively large ships, a number of old Chinese port cities, which developed at some distance from a navigable waterway, have been considerably modified in structure due to the development of newer commercial sections and foreign settlements adjacent to a river or the sea.

fied city function and structure. Rail lines usually terminate outside the walled city and consequently there has been a tendency for a suburban area to develop around the railway station outside the wall. Intracity communication has undergone a change as well, for the foreign innovation of trains, busses, taxis, and private automobiles has greatly modified the traffic of Chinese cities.⁶⁴

RETROSPECT AND CONCLUSION

In a country whose population has always been, and still is overwhelmingly rural and agricultural, cities have continually been an essential part of the settlement structure. Nevertheless, urban population represents a relatively small percentage of the total. With the future industrialization of China and the development of efficient land transportation, cities are bound to grow in numbers and relative importance. To a much greater extent than in those other two great population centers, one on either side of the Atlantic Ocean, cities in China originated and developed as a result of the stimuli associated with administrative functions. These functions apparently are still more prominent among Chinese cities than they are among those of the Occident, although their importance has waned in the modern period as industry and trade have increased. However, only through case studies carried on in the field will it be possible to discover the functions performed by contemporary Chinese cities of different sizes and type locations. What the *raison d'être* for most contemporary Chinese cities is remains largely unknown.

⁶⁴ Chinese urban houses have been dealt with in the following recent article: Joseph E. Spencer, "The Houses of the Chinese," *Geographical Review*, XXXVII (1947): 254-273.

THE POSITION OF THE KÖPPEN Da/Db BOUNDARY IN EASTERN UNITED STATES*

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IT is a recognized fact that Eastern United States experiences winters of great variability. Cartographic proof of this fact has been offered by Kendall¹ in his investigation of Köppen's A/C and C/D boundaries over an 18 year period. Recent variations in the degree of summer heat has prompted this investigation of the position of Köppen's Da/Db line (warmest month over 71.6° F. [22° C.]).

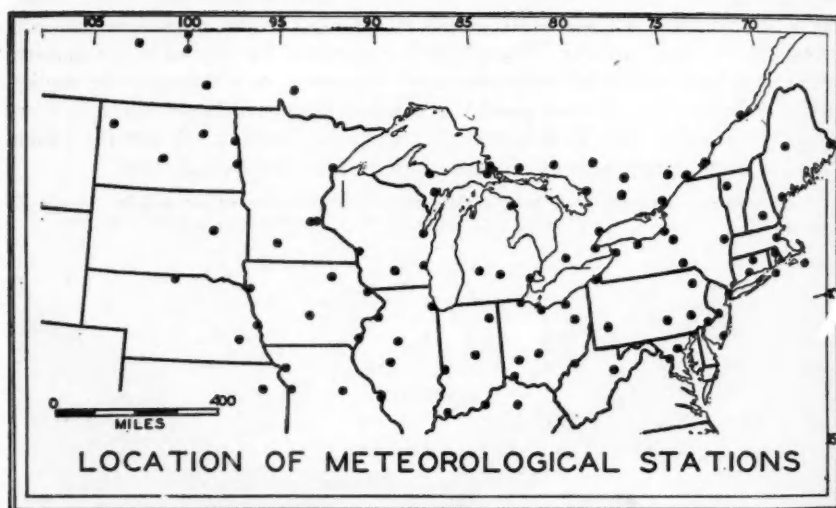


FIG. 1. Location of Meteorological Stations.

The Df climate is of special significance for it is an important agricultural climate. The warm summer phase (Da) is commonly given the title 'Corn Belt Climate' because much of the world's corn crop is produced within areas with this type of

* The author acknowledges the generous aid and encouragement given him in the preparation of this paper by Professor Glenn T. Trewartha of the Department of Geography at the University of Wisconsin.

¹ H. M. Kendall, "Notes on Climatic Boundaries in the Eastern United States," *Geographical Review*, XXV (1935): 117-124.

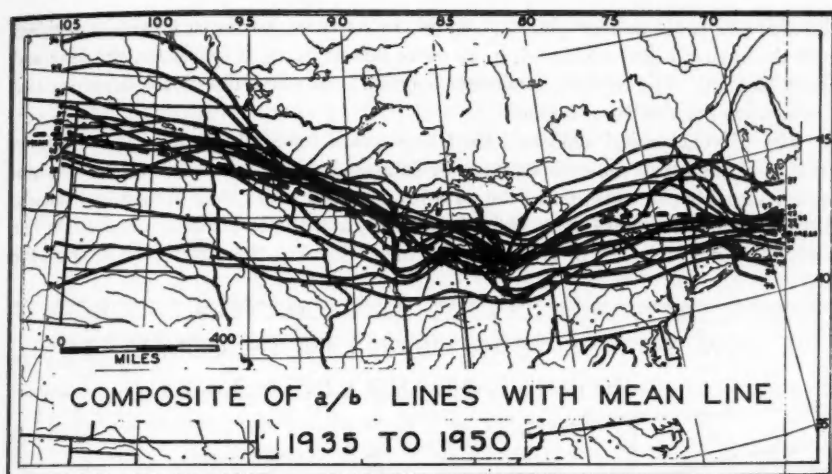


FIG. 2. Composite of Da/Db lines 1935 through 1949. Compare the average variability of this period with figure III.

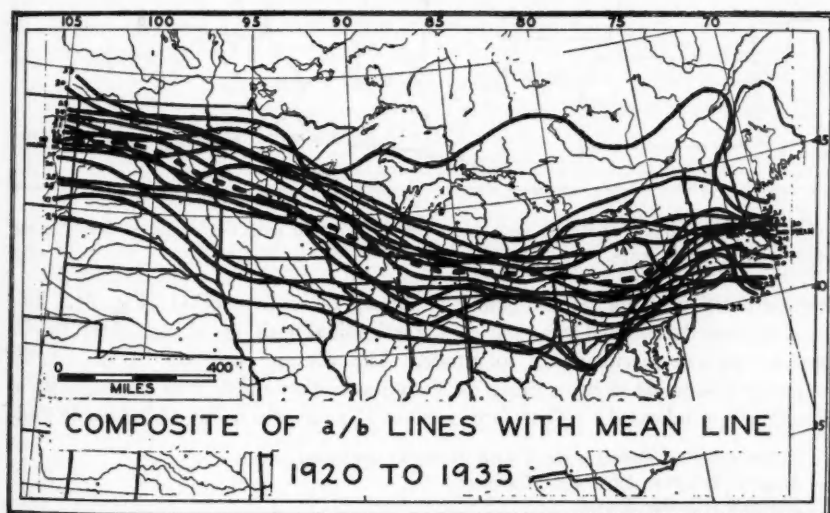


FIG. 3. Composite of Da/Db lines 1920 through 1934. The climatic-year line north of Lake Huron is 1921. Note the greater frequency of Da/Db lines in the latitude of Central Illinois during this period.

climate; the cool summer phase (Db) is, in its drier portions, largely coincident with the spring wheat area, and, in its more humid parts, is known as the Hay and Dairy Region. Hence the a/b climatic boundary—a warm month isotherm—is also an important agricultural boundary.

The 15 year period 1935 to 1950 was selected for study because of its known great variations and the completeness of data available. Several standard climatological sourcebooks were used,² the data for 101 first order stations (20 in Canada, 81 in the United States) were plotted (Fig. 1), and the position of the Da/Db line was determined for each of the years. A mean line was then drawn to indicate the

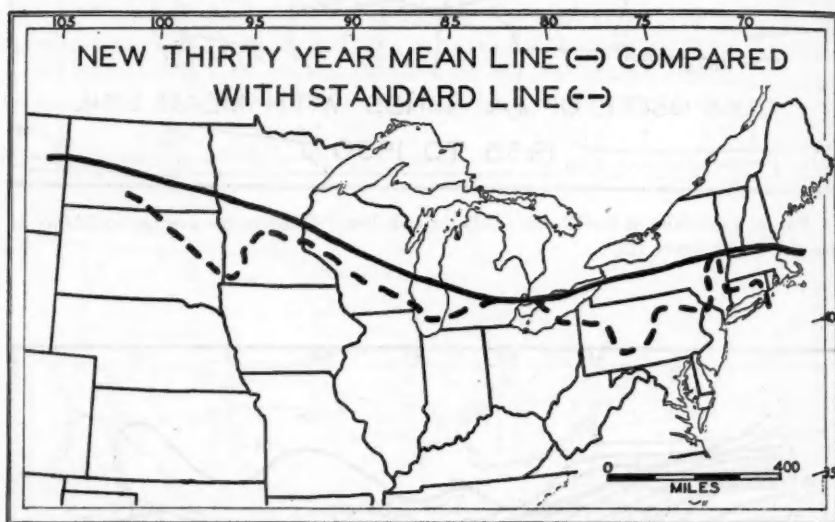


FIG. 4. Comparison of the 30 year mean Da/Db position with the boundary found on the majority of climatic maps.

average position of the Da/Db boundary during the entire period (Fig. 2). This mean line was determined by averaging the latitudinal positions of each of the Da/Db lines at several meridians of longitude. The average position of the Da/Db boundary was found to be as much as 200 miles farther north than the majority of climatic maps indicated.³ Therefore, another 15 year period was added to the study

² *Climatological Data for the United States by Sections*;
Monthly Weather Record for Canada;
Monthly Weather Review.

³ V. C. Finch and G. T. Trewartha, *Elements of Geography*. McGraw-Hill Book Co., Inc., New York, 1949.

Goode's School Atlas. Rand McNally and Company, 1949.

B. Haurwitz and J. M. Austin, *Climatology*. McGraw-Hill Book Co., Inc., New York, 1944.

to verify the original findings. Similar results were obtained during the additional period studied (Fig. 3).

For convenience of presentation the climatic lines are drawn farther west than humid climates usually extend so that those years which were abnormally humid might more completely be included in this study; furthermore, islands of highland-induced "b" modification in the Appalachians were ignored where valley stations gave a less complicated picture.

Study of the figures of climatic boundaries (Figs. 2 and 3) during the 30 years suggests the following:

1. The Da/Db boundary varies considerably in latitudinal position throughout its length in the Eastern United States—almost as much as the C/D boundary of winter⁴—with extreme variations of nearly 700 miles along a single meridian of longitude.
2. Latitudinal variations are more pronounced at the western terminals than at the eastern terminals, reflecting the moderating effects of water.
3. Noteworthy concentrations of the climatic-year lines⁵ occur in Northwestern Wisconsin, Eastern Michigan, and Northern Massachusetts. This pattern seems to be caused by proximity to the bodies of water.
4. A general latitudinal pattern is obvious in all the years studied.
5. Five of the years investigated (1922, 1925, 1937, 1938, 1947) had an August monthly mean temperature which was higher than the July mean of that year. This illustrates an intra-summer variability over and beyond the recognized inter-summer variability pointed out in previous remarks.
6. The mean position of the Da/Db boundary for the 1935 to 1950 period (Fig. 2) is farther north than the mean position for the earlier (1920 to 1935) period (Fig. 3); the average position of these means is still north of the Da/Db line found on standard climatic maps (Fig. 4).
7. Whereas both 15 year periods were slightly above normal during the months studied, the positive departures do not seem large enough to account fully for the new 30-year mean position discovered, especially east of the Mississippi River.
8. Therefore it is suggested that a new Da/Db boundary be accepted for Eastern United States—one which is more in keeping with the climatic facts. This new line varies between coincidence with the old line in Eastern Michigan to poleward displacement of nearly 200 miles in Southwestern Minnesota (Fig. 4).

⁴ Kendall, *op. cit.*, p. 123.

⁵ R. J. Russell, "Climatic Years," *Geographical Review*, XXIV (1934): 92-103.

AN ASPECT OF THE SOCIAL GEOGRAPHY OF INDIANA

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THE birthplaces of the numerous popular authors and journalists, distinguished scientists, and prominent politicians born in Indiana are concentrated much more than the population was at the time of their birth. A fifth of the state, then having about one-fourth of the population, was the birthplace of two-thirds or more of the prominent people born before 1870. Conversely, an area of even greater population produced very few of those notables. The productive area was to the east and south-east of Indianapolis; the most unproductive one was in the north-western part of the state.

The concentration of the birthplaces of an important group of Indiana notables mapped in 1919 aroused my scientific curiosity. Additional lists of Hoosier notables were gathered, their birthplaces plotted, and the yield of each county in proportion to the population at the date of birth was calculated. Correlations with various environmental conditions were sought.

The distribution of production of numerous products of Indiana is widely recognised as a worthy subject of investigation; efforts have been made by geographers to correlate their distribution with certain aspects of the climate, soil, topography, geologic formations, and the like. Surely, corresponding studies of "civilization's most valuable resource, leaders" are desirable. One reason they have been so infrequently made has to do with their complexity and nebulousity. It is much easier, for example, to point out how, in Indiana, extensive production of cantaloupes correlates with sandy soil and with the early coming of the summer heat than to establish the conditions that correlate with the production of men in a particular category, distinguished chemists, for example.

Areal contrasts in the production of notables are obviously so difficult to explain that extensive and intensive research is necessary. Hence, my investigations have been extended to the states near Indiana, and then farther afield, and an increasing number of groups of notables has been studied. However, special attention was devoted to Indiana and to distinguished scientists, partly because lists were obtainable of several well-selected groups. Moreover, data concerning leading scientists were more readily available than for leading engineers, for example. Furthermore, a large number of leading scientists generously answered many questions of a penetrating questionnaire. Indiana has been concentrated on partly because it is a representative state in many respects and because my knowledge of it is relatively adequate. The present paper is a summary of some of my findings. Many details are available in a series of publications.¹

The larger the number of notables studied, the more widespread are their birthplaces. Of the more than 1000 Indiana natives who have been sketched in *Who's Who in America*, about three-fourths of Indiana's 92 counties yielded one or more. Similarly of the partly less severely selected group of 2000 scientists sketched in *Indiana Scientists*, each county yielded one or more. Finally, of leaders in a less prominent way, nearly every community in the state has yielded one or more. Some of these leaders, only locally known, are of real significance. The emphasis here put on certain types of persons who have received national or even international recognition as outstanding should not be interpreted to suggest that they have a monopoly of value. However, in such an investigation as this one, it is almost necessary to deal with impartially selected groups.

First, as to those sketched in *Indiana Scientists* (nearly all of whom were earlier sketched in one or more editions of *American Men of Science*), Indianapolis was the birthplace of 163; Terre Haute, of 55; Ft. Wayne, of 51; Richmond, of 50; Lafayette (including West Lafayette), 46; South Bend, 41; Evansville, 31; Kokomo, 27; Bloomington, 26; and Anderson, Logansport, Muncie, and New Albany, 20 or 21. A total of 21 cities or towns yielded 10 to 19 of these scientists, while 25 places yielded 7 to 9. Lists of names of the scientists born in each place have been compiled. A birthplace list of the 81 starred scientists is published in *Indiana Scientists*.

The 20 counties which yielded most of these 2000 scientists in proportion to their population at about the date of birth of the scientist are mostly in the central and eastern part of the state. Only one borders the Ohio River and only one borders Illinois. Five of the ten relatively least productive counties border the Ohio River and three others are also in southern Indiana; northwestern Indiana has the other two lowest counties, as well as three others that rank relatively low. The central third of the state, in contrast to the northern and southern thirds, contains no county that ranks low. The counties where colleges were conspicuous in 1900 all rank high, the four containing Earlham and Wabash colleges and Purdue and Indiana universities all rank in the upper one-tenth of the counties. All except two notably high counties either had a college or were relatively close to one.

Of the 81 starred scientists, half of the state's counties yielded none, and a quarter of them yielded only one each. By contrast, Marion County (which contains Indianapolis) yielded 5; Johnson, Switzerland and Wayne (Richmond) each

¹ *Geography of American Notables*, Indiana University Studies, 1928, 138 pp.

Scientists Starred, 1903-1943 in American Men of Science, Johns Hopkins Press, Baltimore, 1947, 551 pp.

Indiana Scientists, a Biographical Directory and an Analysis, Indiana Academy of Sciences, Indianapolis, 1951, 300 pp.

More than a score of articles on phases of this subject have appeared in *Science*, *Scientific Monthly*, *American Journal of Science*, *American Scientists*, *American Journal of Psychology*, *American Journal of Sociology*, *American Sociological Review*, *Social Forces*, *Social Science*, *School and Society*, *Journal of Higher Education*, *Journal of Geology*, *Journal of Human Ecology*, *Human Biology*, and *Economic Geography*.

yielded 4; and Allen (Ft. Wayne), Hancock, Jefferson, Union and Vigo (Terre Haute), yielded 3 each. The relatively prosperous Wabash Valley Lowland of the southwestern part of the state, south of Terre Haute, having a population of 220,000 at the average date of birth of the starred scientist (1875), yielded only one such scientist. Fifteen northwestern counties, having then a population of 250,000 people, yielded no starred scientist, although a considerable number of lesser scientists. Fifteen counties east and southeast of Indianapolis (but not including it), having a combined population of 200,000, yielded a total of 25 starred scientists. This is in sharp contrast to the 15 northwestern counties, of 50,000 larger total population at the average date of birth of these scientists, which yield none.

THEORIES AS TO THE CONTRASTS IN YIELD OF NOTABLES

Maps have been made of the yield of notables of various sorts per unit of population at about the time of their birth. Likewise many maps of environmental conditions have been made. A summary of some correspondences or disagreements discloses several significant facts.

1) It is often claimed that differences in climate influence the production of notables. The evidence on this point in Indiana is of interest. Climatic contrasts in Indiana are small; the two sections which differ most widely, the Ohio River Valley and the littoral of Lake Michigan, display no correlation to the yield of notables. However, the sixth of the state possessing the longest hot summer, the southwestern, has yielded far fewer notables proportionately than has the opposite corner of the state, which is coolest. The most productive part of the state is, however, not the coolest. Hence, climatic differences clearly are not an important actor in Indiana in explaining the geographic origins of leaders.²

2) The eminent historian Frederick J. Turner declared, "It often seems to be largely a matter of topography; the level lands yield leaders as well as crops, while the rugged lands produce few of either." The inadequacy of this theory is proved in Indiana, where much of the nearly level land is unproductive of leaders while some of the most productive areas are fairly hilly. Indeed, though the unglaciated, especially hilly part of the state is largely poor in both crops and leaders, it is no less productive of leaders in proportion to population than are some of the most level lands. One of the counties which has stood high in the production of leaders in proportion to population is one of relatively large local relief (Switzerland).

3) Another often-held theory is that "as wealth increases, so does the yield of leaders." Such a correlation does prevail in the blue grass regions of Kentucky and Tennessee, and in various other regions and states, but only slightly in Indiana. The parts of the state having the greatest tangible wealth per average square mile or per capita are not most productive of notables; large sections of relatively rich and prosperous land have yielded few. The parts of the state that have yielded

² See S. S. Visher, *Climate of Indiana* (Indiana University, 1944) for details as to the climate.

coal in abundance are conspicuously unproductive, as are some of the industrially active areas. Although only one of the states' ten exceptionally financially poor counties has yielded relatively many notables in proportion to population, the evidence from Indiana is sufficient to reveal a lack of any close direct correlation between the distribution of material wealth and yield of notables.

4) Another explanation of regional contrasts in the yield of notables is that notables are a product of relatively advanced communities. "Frontiers can not be expected to produce leaders, as the people are engaged in hewing homes out of the wilderness." In Indiana this theory receives some support. The southeastern part of the state, near Cincinnati and northwestward to Indianapolis, the first large part of the state to be well-developed, includes most of the more productive counties. The northwestern section of the state, the most recently developed, has produced relatively few leaders.

The inadequacy of this theory is demonstrated by two facts: (a) the part of Indiana which was most productive 1830-80 has in recent decades become relatively unproductive and (b) the part first settled—and continuously prosperous since 1830, the southwestern, the lower Wabash Valley, in which is located Vincennes, the oldest settlement in the state—has been relatively unproductive of leaders. Not one starred scientist has been born in the region south of Terre Haute and Washington. Crawfordsville was another early cultural center which has yielded no starred scientist, although several have graduated from its Wabash College. Tippecanoe County, containing Purdue University, likewise has yielded no starred scientist, though numerous non-starred scientists.

5) Another theory is that notable leaders come largely from areas which are educationally favored. In Indiana, for example, the four counties containing Earlham and Franklin Colleges and DePauw and Indiana Universities yielded 10 starred scientists, one-eighth of the total number, although at the average date of birth of the scientists these counties contained only 95,000 people, or somewhat less than one-twentieth of the state's population. On the other hand, five of the six counties which had the highest yield of starred scientists in proportion to population lacked colleges. These five especially productive counties are Union, Switzerland, Jefferson, Hancock, and Parke, with a total yield of 13 starred scientists from a population of 82,000 people, or an average of one scientist for 6,300 people.

YIELD OF SCIENTISTS FROM CITY, TOWN, AND COUNTRY

Since geographic conditions in sizable regions in Indiana do not correlate closely with the yield of notables, it is desirable to consider types of land use, specifically the relative productivity of city, town and country. The birthplaces of Indiana's notables have been located in as much detail as possible. A letter was sent to numerous notables asking if they were reared on a farm, in a village or town, in a small city, or in a large city or a suburb. At the time when most of these men and women were born, Indiana was predominantly rural; hence, many were born on farms. However, towns did notably better than did the farms. The

small cities yielded more leaders per capita than did the larger ones, except in the category of men of greatest distinction.

Especial note was made of the contribution of county seats and college towns. The average Indiana county seat yielded notables at a rate more than three times that of the state. College towns (nearly all also county seats) did exceptionally well, more than twice as well as the average town.

This correlation between type of place of birth and yield of notables is far greater than the correlation between yield and topography, soil, climate, material resources, or age of settlement. It apparently reflects the relative attractions of certain types of places for the parents of notables. At the time that most of the notables here studied were born, apparently a large share of the more alert, ambitious people of Indiana were living in towns, which afforded them greater opportunities to use their special talents than did farms.

Occupational groups must be considered in this connection. What are their contrasts in the yield of notables? Data were obtained by questionnaire from many scientists and subjects of *Who's Who* as to the occupations of their fathers. (As to starred scientists, information was also obtained as to the occupations of grandfathers.) The replies reveal that in proportion to their numbers in the population according to the census nearest the birth of the average notable, professional men fathered more than twice as many notables as did business men, nearly 20 times as many as did farmers, about 45 times as many as did skilled laborers, and more than 1,000 times as many as did unskilled laborers. Farmers fathered one-fourth fewer than their share. In other words, only one unskilled laborer in about 38,000 fathered a son or daughter sufficiently noteworthy to win a place in *Who's Who*; one skilled laborer in 13,000 had that distinction; one business man, in 62; one professional man, in 27; and one Protestant clergyman in 15.

WHY DO FEW HOMES YIELD LEADERS?

It is therefore apparent that a small portion of the men of Indiana fathered a large share of the leaders. The interpretation of this concentration is in dispute. Advocates of the theory that environmental influences dominate assert that the people that produced more leaders did so because they could offer better opportunities for cultural and physical development of their children. Conversely, advocates of the theory that hereditary influences are predominant declare that children of unskilled laborers, when adopted into homes of professional men or otherwise given comparable opportunities, nearly always fail to become leaders. They likewise declare that the superior economic status of the fathers of most leaders is the result of their superior qualities of mental alertness, earnestness, ambition, and vitality.

Advocates of the theory that social selection is very important find much support in such data as are here summarized. They point out that the mentally alert people are found chiefly in occupations where their mentality is most advantageous, while the mentally dull are found chiefly in occupations calling for physical strength or routine work. Social selection of another type is illustrated by immigrants of

exceptional ability. For example, many eminent Americans are German descendants, especially of the liberals who came soon after the unsuccessful revolution of 1848. Scotland, both directly and via north Ireland (the Scotch-Irish), also has supplied many ancestors of eminent Americans. But according to much evidence, by far the largest group of American leaders are descendants of emigrants from East Anglia, England, the district which has yielded many eminent British, as well as the ancestors of most of the Puritans of New England, the Quakers, and the Cavaliers of Virginia. The westward spread of the descendants of these immigrants clearly helps to explain the geographical contrasts in the yield of notables. Conversely, their partial submergence numerically in various areas by less productive stocks largely produced the subsequent decline in the per capita yield of notables in those areas.

Another theory is that outstanding leaders come from families that are especially alert, earnest, and ambitious, without respect to their racial backgrounds, and that such people tend to congregate in places of comparative opportunity for them to use their talents. There are bits of evidence from the data as to the Indiana starred scientists which supports this theory. When southeastern Indiana was relatively favored, it produced many leaders, but when, because of the depletion of soil and forest wealth and especially when greater opportunities opened elsewhere, many of the more ambitious people moved away. As a result, southeastern Indiana has yielded few starred scientists for many years. For example none were born since 1880 in four of the southeastern counties which were especially productive earlier (Crawford, Jefferson, Switzerland and Union counties). Likewise not one was born since 1880 in the entire unglaciated part of the state. Indeed, all 42 counties south of Wayne, Johnson, and Vigo have yielded only two since 1881, one born in 1887 (Mann), and the other in 1901 (Twitty).

Another evidence of the selective migration of the parents of notables is that relatively many starred scientists were born in county seats, the local centers of greatest opportunity for talent. The considerable number born in college towns is another evidence. The fact that of the 30 born in Indiana since 1880, 12 were born in the Gas Belt of the late 1880's and 1890's is significant. The boom experienced there attracted relatively many ambitious people. Both of Indiana's Nobel Prize winners, Urey and Stanley, were born in the northern half of the state since 1892.

Another theory to explain the contrasts in yield of notables is that, from young people with the requisite ability, leaders come if they receive adequate encouragement from those close to them and from stimulating teachers, provided opportunities are afforded to them to develop their talents. Conversely, few become such leaders if sufficiently stimulating teachers are not available, if they are not encouraged to prepare themselves adequately, and if opportunities to serve as leaders are not available. This theory has much support in Indiana.

SOME CONCLUSIONS

The areas which yield the most notables are those which contain the most mentally alert, ambitious, persistent, and energetic people possessed of high ideals.

Such people seek opportunities to use their abilities; they appreciate congenial associates and therefore congregate in desirable towns and in choice residential districts or in suburbs.

Detailed studies here summarized indicate strongly that the physical or geographic environmental influences in as favored a land as Indiana often affect indirectly the geographic yield of leaders by concentrating certain types of people rather than directly by affecting diet, occupation, health, and energy. A region comparatively poor in resources usually comes, in time, to be peopled largely with those who are relatively lacking in ambition; the more favored areas attract people possessing relatively large amounts of resourcefulness and energy. In Indiana, the educational and political centers and the suburbs or choice residential sections of prosperous cities are favored areas. Notables and their parents are exceptionally mobile, alert to better their opportunities.

Men and women of distinction are a product of both environment and heredity, certainly not predominantly of one of these. It is essential that certain physical and mental qualifications be contributed by heredity. But numerous persons who possess the biological potentialities fail to become distinguished because of unfavorable environmental conditions.

Of great consequence in a youth's choice of a vocation—meteorology, merchandising, teaching, or professional gambling, for example—is encouragement from one or more persons whom he deeply respects. Such encouragement may change the direction of his life. Stimulating high school and college teachers are notably significant. Also significant is the influence of other highly-respected people in the communities. The success of others from the childhood community also helps to explain why certain small Indiana places yielded first one outstandingly successful scientist and later more scientists. A considerable number of scientists were children of educators and scientists.

Highly significant in the yield of a particular place are the opportunities there for work. Some Indiana cities and towns have relatively many opportunities for able and earnest young people. This helps to explain the important yield of college towns.

REVIEWS AND ABSTRACTS OF STUDIES

A GEOGRAPHY OF SOUTHEAST ASIA

E. H. G. Dobby. *Southeast Asia*. 415 pp.; index; bibliography; maps and diagrams. John Wiley & Sons, Inc., New York, 1950. \$5.00.

All students of southeast Asia will recognize that Professor Dobby of the University of Malaya has written the definitive volume on this part of the world. *Southeast Asia* is a comprehensive analysis of the natural landscape and human geography of the area as a whole and of its respective political areas. The text reads well and has the sure touch of one who has long lived and worked in the area. For the benefit of those whose interests lie elsewhere, the following summarized quotations will indicate the scope of Professor Dobby's volume.

This is a study of "locational perspectives." In considering climatic factors, the author points out that "Few regions comparable in size to Southeast Asia have so uniform a temperature regime over the whole area and throughout the year. . . . The basic rhythm of plants and agriculture through most of Southeast Asia is dominated by rainfall—by its incidence rather than by its volume." (p. 31)

Two winds dominate this area, the Northern and Southern Tropical Air Masses. "The physical character of the air is much the same in these two masses, which each have long courses across extensive warm seas, so that each is uniformly warm and uniformly damp. Furthermore, the air masses are both losing impetus as they move into lower latitudes. Where the Northern and Southern Tropical Air Masses converge is thus a front. . . . The similarity of physical conditions in these air-streams means that the Intertropical Front is less sharply defined at any one time by comparison with the Polar Front. . . . The warmth, the humidity and the loss of horizontal impulse in each of the Tropical Air Masses mean that vertical impetuses are increasing so that the Intertropical Front is marked by upward movements on both sides, tending to a vigorous convectional action. . . . When the airstreams cross the Equator, Ferrell's Law operates upon them differentially so that Southeast Trades moving into the Northern Hemisphere become southwesterly winds and Northeast Trades become northwesterly winds when moving into the Southern Hemisphere." (pp. 32-33)

"The tropical air masses operating over Southeast Asia are characterised by high temperatures and humidity, coupled with a physical instability which is greatest towards the Equator and decreases towards the continent of Asia. As a result of this instability, relatively weak depressions, small relief features and local overheating by insolation . . . can act as triggers to stimulate violent vertical air movements. . . . Under these conditions cumulo-nimbus clouds of as much as 10,000 ft. depth may develop within an hour and vertical air currents of 100 m.p.h. inside such clouds are quite common. With the parent air so humid, the precipitation consequent on such updraughts is very heavy." (p. 36)

"In the regime of tropical rivers several factors have distinctive emphasis compared with conditions in temperate latitude rivers. Firstly the volume of water precipitated into and to be carried from any drainage basin is several times that of equivalent temperate latitude rivers. . . . Even the dry interior of Burma experiences falls of rain averaging 6 inches per rainy day. The water content of those Tropical Air Masses over Southeast Asia is so high and the rising air currents so strong and sustained that several Javanese stations have recorded falls of over 16 inches per day. . . . A further consequence of these great rainstorms is their powerful erosive effects . . . the soil rapidly washes away and whole hillsides may slip, so that the runoff has a high mud content. . . . The very heavy load of Southeast Asia rivers gives them a great capacity for rapidly building up deltas, sedimenting the estuaries and at times causing heavy depositions of silt well inland." (pp. 47-48)

All of this leads to large inland swamps since torrential downfalls are so intense that surface water is greater than the capacity of the streams to remove it.

"Because the whole year is here a growing season, plant life becomes almost overpowering in its rate of growth. This region contains more species than any other; the flora is not yet completely known, but some 35,000 species of flowering plants alone are thought to exist there. . . . Only in modern times has there been any extensive clearing because apart from firing, primitive people were technically incapable of removing the forest." (p. 61)

"Migrant agriculture or shifting cultivation, in Malaya called *ladang* and in Burma *taungya*, is widespread throughout Southeast Asia and it may be this form of nomadism has in fact operated so long that it affects nearly every acre of the region. . . . Much forest which we call 'primary' may be senile secondary." (pp. 61-62)

"Tropical Rain Forest is remarkable for the number of tree-types which go to make it and for its heterogeneous composition. Continuous stands of any single tree species very rarely occur, and often thirty may be found in a forest patch 100 yds. square." (p. 67)

"With certain local exceptions, Southeast Asia experiences an annual excess of rainfall over evaporation. This means that there is a steady movement of rainwater downwards . . . [this] effects a steady removal (leaching) of the solubles in Southeast Asia soils. While a thick vegetation cover continues to be in place upon the surface, replacement of some solubles by humus renewal goes on all the time, but once that vegetation is removed, the surface soil rapidly loses its existing soluble elements, receives no renewals and becomes infertile, a factor making continuous agriculture a drain upon the soil. . . . The distinctive point is that high tropical temperatures and heavy rainfalls give groundwater great power both to dissolve and to carry away special selections of the solubles." (pp. 75-76)

Both *podsolisation* and *laterisation* are present. "Mature laterites may be up to 100 ft. thick, all weathered *in situ* and justifying the word 'soil' to describe it. Several distinct horizons occur within this thickness. On top is a few inches of forest soil, dark with humus and partially decayed matter. Under this is red earth, crumbly and sticky to the hand, permeable to water yet easily 'baking' if ever exposed to the direct sun. Much of the water is held colloiddally. . . . Four or five feet below the surface a distinct cellular structure develops, consisting of a coarse network of iron compounds round softer cores of clay. This is the horizon which may be of that hardening type suitable for a structural material. Sometimes the iron compounds at this level change *in situ* into hard concretions like a pan roughly paralleling the surface and looking like a lustrous slag. . . . Beneath the concretion layer is another horizon of almost continuous saturation where the coloration tends to be less red and more yellow or whitish right down to the horizon of decomposing rock." (pp. 79-80)

"Southeast Asia has several agricultural

types which are, however, less related to major climatic or environmental differences between one place and another and more to differing rates of agricultural development . . . particular interest attaches to shifting cultivation because it represents a special stage in the evolution from hunting and food gathering to sedentary farming. . . . Some shifting cultivators are true wanderers. . . . Others are sedentary farmers, staying in one village all their lives, but varying the piece of ground they cultivate from time to time. . . . As soon as population increases, shifting cultivation, which needs each cutover area to stand unused for 7 to 10 years before being recultivated, rapidly overtakes the capacity of the forest vegetation to reassert itself. Hence much of Southeast Asia has been progressively overburnt by the increasing forest population and the natural cover has selectively changed towards the savannah vegetation type. . . . Overburning caused by overpopulation in turn induces rapid soil erosion, affecting the load and silting of river systems, possibly disturbing settled agriculturists far down the valley . . . shifting cultivation . . . still persists in . . . as much as 5 million acres of temporary clearing each year." (pp. 347-349)

"The oldest cash farming of Southeast Asia was the spice trade of the Moluccas." (p. 351) Today commercial agriculture occupies 35 million acres and includes rice, sugar, coffee, tea, cinchona, and oil palm.

"Because equatorial waters have low salinity and low oxygen content, it has frequently been assumed that they have a low fish population. That view is difficult to maintain for the shallow waters of Southeast Asia where, according to Herre, the number of kinds of fish and their diversification is unrivalled by that of any other marine region." (p. 360) The importance of fresh water fishing is shown in the statement that "From Tonle Sao over 25 tons of fish are produced annually from each square mile of its surface, a productivity ten times greater than that of the well-fished North Sea of Europe." (p. 363)

"Broadly speaking, the region has been until recently one of very thin population and large patches of it still contain populations of remarkably low density. Direct evidence of densities are scanty for periods farther back than this century, yet it seems probable that the whole of Southeast Asia in 1800 contained only about ten million people. . . . But the last 150 years brought tremendous changes in population . . . causing people to swarm upon the more fertile areas, upon deltas and

volcanic cones where people had not clustered before . . . so that upon them live teeming multitudes in limited zones separated by stretches of forest-covered space scarcely more populated now than they were several centuries ago." (pp. 385-386)

"The resulting pattern of people is one of unparalleled diversity in stages of evolution from subsistence to commerce, in densities of people, in ethnic types, in languages. . . . Political and economic forces released in Europe and America had their repercussion within Southeast Asia. . . . All sorts of colonial systems have been experimented with, so that Southeast Asia has a great range of constitutional forms, from fossilised oriental aristocracies to democracies of a few intelligentsia and to would-be republics." (pp. 390-391)

These quotations have been taken from Parts I and III, each of which deals with the area as a whole. Between them are 250 pages of rich description, typically with three chapters for each country termed Natural Landscape, Cultural Landscape, and Social Geography. Although mineral resources and the mining industry receive frequent mention the reviewer would wish that more attention had been given to these potentials. Professor Dobby does recognize that in the absence of coal for smelting, many of these mineral resources would have to be processed outside the area.

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POLITICAL GEOGRAPHY OF MACEDONIA

H. R. Wilkinson, *Maps and Politics: A Review of the Ethnographic Cartography of Macedonia*, 366 pp., appendices (including bibliography), photograph, maps, index. Liverpool: University Press of Liverpool, 1951.

Wilkinson has chosen an unusual method of presenting a study in political geography through description and analysis of ethnographic maps pertaining to the Balkan problem area of Macedonia, which is certainly one of the classic areas of complexity of ethnographic structure. The author poses two distinct aims for the study. "The first has been to demonstrate the origins and development of the Macedonian problem by arranging and presenting the evidence to the best possible advantage with the aid of cartographic devices. The second has been to use the Macedonian maps to exemplify the characteristics of ethnographic maps in general, the merits and limitations of which do not appear to be generally appreciated."

The historical development of the "Macedonian Question" is traced through a chronological survey and analysis of some two hundred selected ethnographic maps beginning with the *Europa Polyglotta* of 1730 and ending with recent maps of the postwar period. The complicated problem of reproduction of the diverse ethnic groupings indicated on the original maps, many of which were in color and in differing map scales, was met by re-drawing the originals in black and white to a comparable scale wherever possible and by

using a standard pattern of representation of the major ethnic groups listed as Turks, Greeks, Slavs, Vlachs, and Albanians. The discussion technique employed is to give a description and critical analysis of each map and to place the map in its proper time perspective in relation to other events affecting Macedonia by means of an accompanying discussion of the pertinent broader political, historical, and military aspects of each period. A novel feature of the summary is the graphic presentation on summary base-maps of the ideas held at different periods concerning the geographic distribution of the main ethnic groups. For example, Figure 79 gives twelve views on the distribution of the Turks from 1730 to 1944. In similar fashion, Greek, Serbian, Bulgarian, and Albanian historical aspirations in Macedonia and adjoining territories are also graphically summarized.

The constant theme of *Maps and Politics* is the interaction between ethnographic ideas and nationalist aspirations in Macedonia. Wilkinson points out that it was during the nineteenth century that ethnic structure achieved increasing importance as a criterion of political affinity and that Macedonia, as an area of strategic and economic possibilities, but of "obscure" ethnic structure, became a prime area for the justification of expansionist aspirations, particularly on the parts of Bulgaria, Serbia, and Greece, through tendentious interpretations of Macedonian ethnography. He considers this relationship as the key to the understanding of the political geography of

Macedonia, and his "evidence" gives ample support to his conclusion that "ethnographic maps of Macedonia are inseparable from their historical context."

Wilkinson has done a thorough and painstaking job of collecting and evaluating the ethnographic maps of Macedonia, his research including a postwar visit to Yugoslav Macedonia. Without doubt, he has made a worthy contribution to the understanding of the complex problem of Macedonia through his excellent graphic presentation, although it would have been of great aid to the reader if he had included a location map of the numerous places and areas mentioned in the text. This study is also a valuable source book on techniques of handling ethnographic data on maps, and

should arouse a great deal of interest in the utility of such maps for the geographer. But, in the opinion of the reviewer, the conclusions of the author as to the general unreliability of ethnographic maps pertaining to Macedonia should not be applied to ethnographic maps in general without further investigation of the reliability of ethnographic maps in other areas. Macedonia is an exceptional case wherein scientific validity was usually subordinated to political purposes to such an extent that one might say that the maps were only as good as the intentions of the maker.

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KOREA

H. Lautensach: *Korea: Land, Volk, Schicksal*.
Stuttgart: K. F. Koehler Verlag, 1950.

Professor Lautensach has already written a major work on Korea that was published in 1945. This was intended for a limited public, but in 1949, when Korea had become one of the world's "red-hot spots," this major work was out of print. Hence this shorter summary volume was written for a wider (German) public. The book falls into five sections. Part I deals with the history of Korea down to the withdrawal of the United States troops in the summer of 1949 and the conflicts that broke out on the border between North and South Korea in July and August of that year. Part II deals with the over-all characteristics of the land—landforms, geological structure, climate, water supply, natural vegetation and its transformation, and agriculture. Five detailed maps illustrate each of these sections.

Part III is a section on the Korean people—the race and its mental characteristics, the distribution of the population, farm types, the effects of religion on the material landscape forms, modes of livelihood, villages and towns, and trade. Studies of selected areas and of chief cities then follow in Part IV. Part V is an entirely new section (the preceding parts are a summary of the content of the major work.) It contains a comparison of North and South Korea in relation to the current problems of the country as divided into two zones of occupation on either side of the 38th parallel. Statistical tables and a brief bibliography complete the book. It contains 32 excellent photographs and a folded map on a scale of 1/2,000,000.

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